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ABSTRACT

To assist Congress in preparing for the reauthorization of the Carl D. Perkins Vocational Education Act, the Office of Technology Assessment (OTA) examined the technical feasibility and utility of instituting specific requirements for performance measurement of secondary school vocational programs. The OTA examined two types of performance measures--labor market indicators and occupational competency testing--but did not evaluate the overall strengths and weaknesses of a federal decision to mandate these or other measures. Labor market indicators were found to be an important but insufficient measure of overall school or program performance. Occupational competency tests were found to provide important but insufficient indications of program effectiveness and were not recommended as the sole basis for performance standards. As a result of the study, it is suggested that an important role for the Federal Government to play would be to encourage a broad view of performance measurement and that, in particular, Congress could play a leadership role by helping states to (1) develop clear definitions of the objectives of their vocational programs; (2) establish agreed-upon norms of measurement and guidelines for data collection and analysis; (3) carry out research aimed at the development of improved technologies for testing; (4) conduct pilot demonstrations of the effects of alternative performance standards on school and student behavior; and (5) raise necessary funds for dissemination of innovations in performance assessment methodologies. (CML)

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Performance Standards for Secondary School Vocational Education

Background Paper

April 1989

Science, Education, and Transportation Program
Office of Technology Assessment
Congress of the United States
Washington, DC 20510-8025

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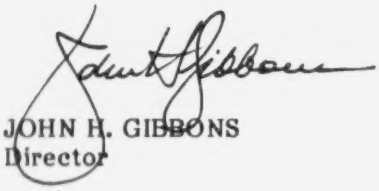
FOREWORD

Following nearly a decade of education reforms aimed at raising the performance of American high school students in academic subjects, there has emerged a broad consensus for improving the quality of vocational programs as well. Because so many students take vocational courses, regardless of their career plans, and because secondary school vocational training can affect job productivity and performance, the content and management of vocational programs warrant careful attention.

To assist Congress in reauthorization of the Carl D. Perkins Vocational Education Act, the House Committee on Education and Labor asked OTA to explore the possibility of instituting specific requirements for performance measurement of the Nation's secondary school vocational programs. OTA examined the technical feasibility and utility of performance standards based on labor market indicators and scores on occupational competency tests, and looked at other possible measures as well.

This Background Paper contains the results of OTA's analysis. Throughout the study OTA sought and received the assistance of many individuals and organizations in the business, education, and government communities. Their thoughtful contributions and criticisms were invaluable, although their participation does not necessarily reflect their endorsement of the contents of the report, for which OTA bears sole responsibility.



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Performance Standards
For Secondary School Vocational Education

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Performance Standards
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SUMMARY

To assist Congress in preparing for the reauthorization of the Carl D. Perkins Vocational Education Act, OTA was asked to examine the technical feasibility and utility of instituting specific requirements for performance measurement of secondary school vocational programs. The Perkins Act currently specifies the composition of State advisory boards, which are charged with developing skills inventories, the establishment of evaluation criteria, and biennial program evaluation. The act also mandates that States assess the quality of vocational programs in terms of workplace requirements and occupational preparation of students. But these requirements are not rigorously enforced. The education and business communities now increasingly support the view that more exacting measurement of the quality of high school vocational programs may be needed. OTA examined two types of performance measures, but did not evaluate the overall strengths and weaknesses of a Federal decision to mandate these or other measures.

CONTEXT

The secondary school vocational system is complex. Recent data indicate that virtually all American high school students take at least one vocational course, one-half of all students take four or more vocational courses, and there is almost no difference in the number of vocational course credits taken by students in different racial and ethnic groups. In addition, almost one-half of all vocational credits are taken by college-bound students, and there is growing recognition that all students — vocational or not — need academic skills to function productively when they leave high school.

Interest in measurement of vocational program quality comes at a time of heightened concern for the relationship between the Nation's educational system and the future of the American economy. Growing evidence of a work force ill-equipped for many jobs that require higher skill levels, demand by industry for workers able to learn new skills and adapt to new technologies, concern for the economic well-being of approximately 20 million noncollege-bound youth, and the recognition that many vocational students who go on to college are well served by job skills has spurred education and business leaders to redefine the objectives of secondary school vocational programs and to demand improvements in their quality. There is now widespread consensus for including the vocational education system in the national debate over school reform and academic excellence.

OUTCOME MEASURES

One manifestation of the concern for quality of vocational programs has been the interest in using outcome measures as indicators of program effectiveness. The application of outcome-based performance standards in other Federal employment and training programs, such as the Job Training Partnership Act, has led many observers to call for a similar strategy in vocational education.

OTA looked closely at two outcome measures: 1) indicators of labor market performance of vocational graduates, including job placement, earnings, and duration of unemployment; and 2) competency in occupationally-relevant skills, as measured by scores on tests of vocational ability. These are the most frequently discussed measures, are currently the most quantifiable, and — most important — they reflect the broadly accepted definition of the principal objectives of secondary level vocational training: the preparation of high school students for productive and gainful employment.

There are a number of other outcomes that could be included in assessments of program quality. OTA discovered considerable interest in widening the scope of performance measurement to account for the multiple objectives of secondary vocational training. While OTA did not analyze these measures in detail, they do warrant continued attention. For example, many observers have suggested that vocational programs may reduce the high school dropout rate, and that keeping students in school who might otherwise quit could be counted as a positive outcome of vocational programs. Similarly, participation of vocational graduates in postsecondary education could be counted as a positive outcome. Other measures, such as the market value of goods produced by vocational students while still in school (e.g., in cooperative education programs) and the likelihood of vocational graduates being selected for employer-provided training, have also received attention.

OTA also learned that many States, in response to growing pressure for academic reform, have begun to introduce academic material into the vocational curriculum and to try to teach so-called "higher-order thinking skills" that will benefit students throughout their careers. Many people now wish to see academic achievement included in vocational performance measurement, and would like to see improvements in testing technology to provide better assessments of higher-order cognitive abilities.

Because measurement usually implies the development of standards that can become the basis for sanctions or incentives, selection of <u>any</u> outcome measures will have a strong impact on program management and curriculum design. Thus, as Congress debates the feasibility and utility of performance measurement, it will undoubtedly engage in a broader discussion of the objectives of the vocational education system.

PRINCIPAL FINDINGS

Labor Market Indicators

Job placements, wage rates, earnings, and duration of employment and unemployment of students who complete defined courses of vocational study can provide important clues to program quality. If graduates of two programs with similar objectives and in the same or similar communities experience significantly different labor market outcomes, the relative quality of the two programs can be said to differ. Indeed, because a primary objective of vocational training is productive employment, how vocational program graduates fare in the labor market can be an important reflection of the programs from which they graduated.

But technical and methodological problems have always created barriers to effective use of labor market indicators for program evaluation. These problems include the questionable validity of information provided by program graduates about their current employment and prior coursework, the potential for bias in data provided by school personnel (especially if the performance standards become a basis for program funding), and the high costs of conducting followup surveys of a mobile labor force.

Recent improvements in the quality and cost of data collection and storage, made possible by mandated changes in employer reporting of wage and earnings data, provide partial relief for these concerns and increase the feasibility of designing cost-effective labor market outcome indicators. In particular, the use of wage records maintained by the States in compliance with recent amendments to the Social Security Act could be a first step toward improved labor market indicators of program performance. The wage records data are more accurate than self-reported survey information, allow for longer-term evaluations of employment, and can be merged with other data such as military records or computerized school transcripts.

There remain some important technical issues to be resolved before the wage records system could be implemented for secondary vocational program evaluation. First, school transcript information is not uniform, despite recent efforts to standardize vocational course definitions and curricular offerings. In addition, clarification of confidentiality restrictions pertaining to individual financial data, and the decision to maintain long-term archives of earnings and employment data, would be minimal prerequisites to implementation of the wage records system for performance evaluation.

Even with these technical improvements, however, labor market indicators alone are an insufficient basis for performance standards, for several reasons:

- It will always be difficult to isolate the specific effects of school programs from the geographical, demographic, and other nonschool factors that determine individual success in the labor market, and it is prohibitively costly to collect and analyze the detailed student background data that would be necessary to overcome this problem. Alternative solutions, such as conducting controlled experiments or using sophisticated statistical correction methodologies, are not practical.

- The use of some labor market indicators could distort school behavior: placement rates, for example, especially if used as the basis for sanctions or rewards to schools, could induce schools to concentrate too heavily on coaching students in job search and interview skills at the expense of teaching vocational competencies that would benefit them in the workplace.

- Idea. labor market indicators would include information on items not currently part of the wage records system, such as participation in employer-sponsored training, measures of employee morale, job performance, and productivity. These types of information are difficult and costly to obtain.

For these reasons, OTA finds that labor market indicators are an important but insufficient measure of overall school or program performance.

Tests of Acquired Skills

Competency tests designed to assess mastery of skills can also be valuable as part of a comprehensive approach to program evaluation and can provide useful feedback to local program staff. When linked to data reflecting labor market needs, the tests are useful for evaluating the relevance of vocational curricula to current and anticipated conditions. In addition, tests that measure more broadly defined developed abilities can, when used properly, contribute relevant information about the types of courses offered by schools and about efforts to provide special guidance or coursework to students who need it most. For performance measurement, tests designed expressly for system-wide program evaluation are preferable to those meant for assessment of individual abilities.

The States have become very active in the development and use of occupational competency tests. Detailed paper-and-pencil tests, as well as hands-on tests of technical proficiency — which are often designed with the cooperation of experienced workers — can provide valuable information about the quality of vocational programs. State-of-the-art tests that rely on computer-based interactive systems, which are currently being designed, may provide important technological improvements over conventional testing modes.

Occupational competency tests, like labor market outcomes, provide important but insufficient indications of program effectiveness, and could not become the sole basis for performance standards, for several reasons:

- It is never possible to know exactly how much of an individual's developed abilities can be attributed to a school or program. Accurate interpretation of test results requires a high level of sophistication in accounting for socioeconomic and other correlates of test performance.

- Depending on the type of test used (e.g., multiple choice) there is a risk that schools will coach students on test-taking strategies and on specific test items at the expense of teaching the skills and concepts purportedly measured by the tests.

- Most tests are designed to measure the upper limit of what a person can do, and do not necessarily indicate how a person would typically perform at work.

- There are too many different occupations taught in American schools for there to be a viable national competency test. In addition, tests that accurately assess what is taught in specific courses could encourage excessive emphasis on highly specialized skills at the expense of more broadly applicable generic skills. There is a growing consensus that the pace of workplace innovations will require

flexibility: for example, many people have argued that vocational graduates need "learning-to-learn skills" and the ability to work effectively in teams, as well as job-specific proficiencies.

The Federal Role

Performance standards based on labor market indicators or test scores are useful, but neither approach can fully capture the complex goals of secondary vocational education. An important role for the Federal Government to play is to encourage a broad view toward performance measurement.

In addition, the design of standards depends on the definition of vocational program objectives. Because both the definition and attainment of program objectives are sensitive to local and regional differences, there is no single measure that can yield a national standard. The Federal Government could effectively encourage and support the States, individually or in consortia, in their current efforts to define outcomes and devise appropriate measures of performance. In particular, Congress could play a leadership role by helping States

- develop clear definitions of the objectives of their vocational programs;
- establish agreed-upon norms of measurement and guidelines for data collection and analysis;
- carry out research aimed at the development of improved technologies for testing;

- conduct pilot demonstrations of the effects of alternative performance standards on school and student behavior; and

- raise necessary funds for dissemination of innovations in performance assessment methodologies.

Chapter 1

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Chapter 1

Introduction

AN ATMOSPHERE OF REFORM

Rapid technological change in the workplace, coupled with intense international competition, have focused national attention once again on the role of the schools in preparing youth for productive employment. The ominous news seems relentless: declining test scores, growing numbers of high school students unable to perform simple arithmetic, poor showings of American youth in international comparisons of academic ability, a national dropout rate of roughly 25 percent, and forecasts of relatively high demand for workers with technical skills. There are many reasons to wish for better educational opportunities for American school children. But economic considerations — the productivity growth slowdown and America's struggle to remain competitive in the global economy — have provided the main impetus for reform. And while it is erroneous to pin the blame for America's economic difficulties entirely on the education system, many people believe that basic features of the school system — who is taught which subjects? when? how? — need to be redesigned to fit the realities of the post-industrial world.[1]

Things are changing. As OTA pointed out in a recent report on educational technologies, American schoolrooms today still resemble their ancestors of 50 years ago more closely than do business organizations, manufacturing plants, hospitals, or university research facilities.[2] But there is an extraordinary consensus in the country

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1. It is important for school reformers to avoid mistaking the coincidence of test score decline and economic downturn for cause and effect. See Richard Murnane, "Education and the Productivity of the Work Force: Looking Ahead," *American Living Standards*, Robert E. Litan et al., (eds.) (Washington, DC: Brookings Institution, 1988), p. 215; and John Bishop, "Why the Apathy in American High Schools?" *Educational Researcher*, vol. 18, No. 1, January-February 1989, pp. 6-10.
2. U.S. Congress, Office of Technology Assessment, *Power On! New Tools for*

today that technological innovation at the workplace, changing demographic composition of the school population, modern understanding of multiple learning styles, and the advent of new learning technologies need to be reflected in the way schools are organized and in the way instruction is designed. At least since 1983, when the Department of Education declared this was a "Nation at Risk,"[3] nearly all the States have begun implementing reforms: increased graduation requirements, more standardized testing, lengthening the school day and the school year, imposing sanctions for poor performance, and designing new teacher certification processes are the most common strategies.[4]

While there is much variation in the way the States have approached the design and management of change, overall "accountability" has become a guiding principle. Schools are expected to act like businesses, and account for their successes and failures; and though it has never been very easy to apply quantitative measures to complex educational processes and outcomes, more and more school systems have been doing just that. In many places, performance measurement has become a basis for incentives or sanctions directed at various levels of the educational system. For example, merit pay for teachers is an attempt to reward teachers for superior performance, while so-called "bankruptcy" laws penalize school districts for poor performance by transferring their assets and liabilities.[5]

Teaching and Learning, OTA-SET-379 (Washington, DC: U.S. Government Printing Office, September 1988).

3. U.S. Department of Education, *A Nation at Risk: The Imperative for Educational Reform* (Washington, DC: U.S. Government Printing Office, April 1983).

4. For different views on the potential for education reform, see Thomas B. Timar and David L. Kirp, "State Efforts to Reform Schools: Treading Between a Regulatory Swamp and an English Garden," *Educational Evaluation and Policy Analysis*, vol. 10, No. 2, summer 1988, pp. 75-88; John Chubb, "Why the Current Wave of School Reform Will Fail," *The Public Interest*, No. 90, winter 1988, pp. 28-49; and Chester Finn, "Questioning Cliches of Education Reform," *Education Week*, Jan. 25, 1989, p. 40.

5. For a review of incentive and sanction programs instituted in various places in the United States, see David Stern, University of California, Berkeley, "Performance Incentives for Secondary Vocational Education," OTA contractor report, December 1989.

THE ROLE OF VOCATIONAL EDUCATION

Most high school performance measures of the past decade have emphasized academic test scores and performance in college. Occupationally-specific learning has received less attention, and the vocational education system has remained at the fringes of the major reform debates. Because of the perception that effective job training at the secondary level is an important element of economic resurgence, the education and business communities now agree that the time has come to position the future role and structure of vocational education squarely in the broader education policy debate.

Vocational education is a complex system. With its origins dating to early 20th century demand for skilled workers, vocational education has been traditionally viewed as the principal training ground for noncollege-bound youth entering technical trades. But recent data indicate that enrollment in high school vocational education is nearly universal: 97 percent of the high school graduates from the class of 1982 enrolled in at least one vocational course, one-half of all students took at least four vocational courses, and most students who took one vocational course followed through with a second or later course in a sequence leading to specific occupational proficiencies.[6]

Most stereotypes about vocational education are inaccurate. For example, there is almost no difference in the number of vocational course credits taken by white, Black, Hispanic, and Asian students. As shown in figure 1-1, the range is from about three credits, on average, for Asian students to slightly over four credits among Blacks. Perhaps more striking are the data illustrated in figure 1-2: the percentage of students taking two vocational course credits is roughly the same whether or not they plan to attend college; and roughly 10 percent of students planning to go on to graduate or

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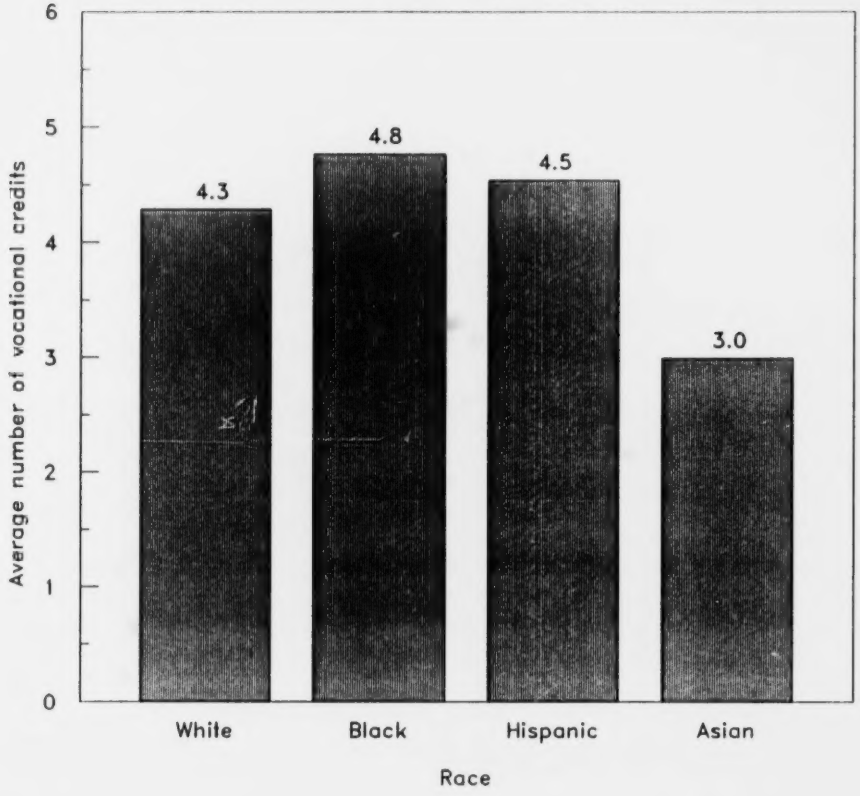
6. U.S. Department of Education, *First Interim Report From the National Assessment of Vocational Education* (Washington, DC: January 1988), p. 1-5.

Figure 1-1

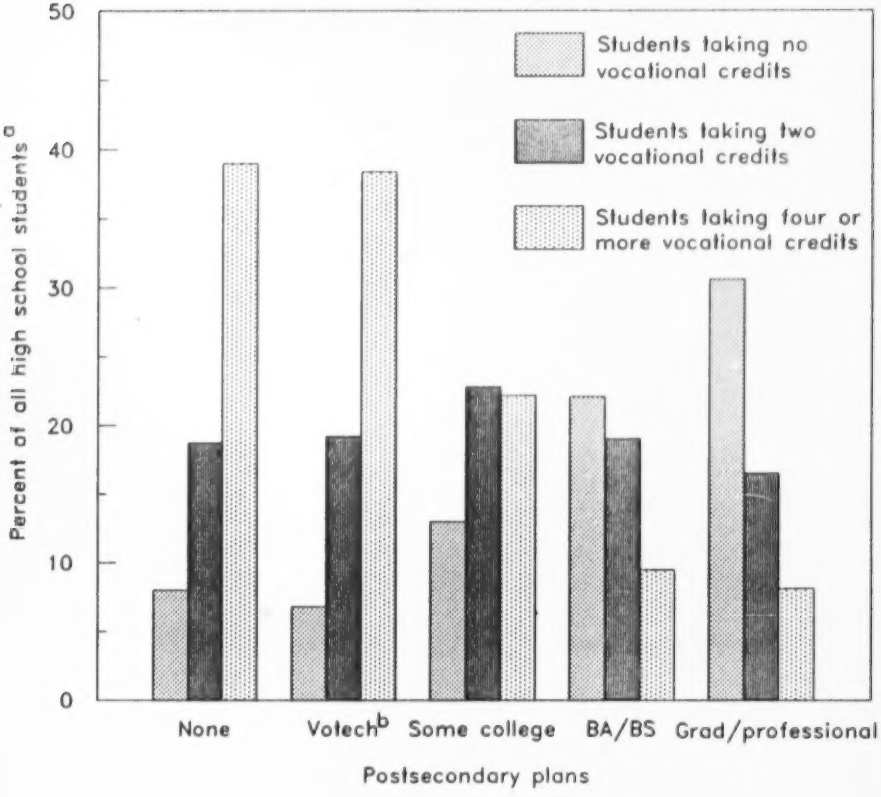
Vocational Education Credits Taken in High School, by Race of Students



SOURCE: Office of Technology Assessment, based on the National Assessment of Vocational Education, First Interim Report (Washington DC: U.S. Department of Education, January 1988).

Figure 1-2

Completion of Vocational Course Credits in Primary Subjects, by Students' Postsecondary Plans



[a] Does not include percentages of students taking one vocational course credit or three vocational course credits. Columns do not total 100 percent.

[b] Vocational/Technical colleges.

SOURCE: Office of Technology Assessment, based on the National Assessment of Vocational Education, First Interim Report (Washington DC: U.S. Department of Education, January 1988).

professional school take four or more credits in vocational courses. In addition, almost one-half of all vocational credits are taken by college-bound students.[7]

Figure 1-3 shows that ability of vocational students, as measured by verbal and mathematics achievement tests, is also a poor predictor of participation in vocational courses. Students ranking in the middle two ability quartiles took an average of just under five credits and accounted for more than 50 percent of vocational enrollment. Only in the highest ability quartile did participation decline significantly. Socioeconomic status had much the same effect, as illustrated in figure 1-4.

Outcome Measures for Secondary Vocational Education

The Carl D. Perkins Vocational Education Act reflects traditional congressional concern with equity in access to public education. For example, it mandates procedures to be used by the States in allocating portions of set-aside grants for handicapped and economically or educationally disadvantaged students. But the Perkins Act also recognizes the potential role of outcome measurement in vocational programs: the act requires States to establish boards to review vocational curricula and their relevance to labor market needs, and specifies that the boards must be composed of business and education leaders in the community according to Federal guidelines. However, these outcome requirements do not include methodological guidelines, and they are not rigorously enforced.

The reauthorization of the Perkins Act comes at a time when performance incentives and quality indicators are very much in vogue, in the schools as well as in job training programs outside the schools (see box 1, page 21). Many people are urging Congress to apply similar measures for secondary vocational education. As one prominent researcher explained:

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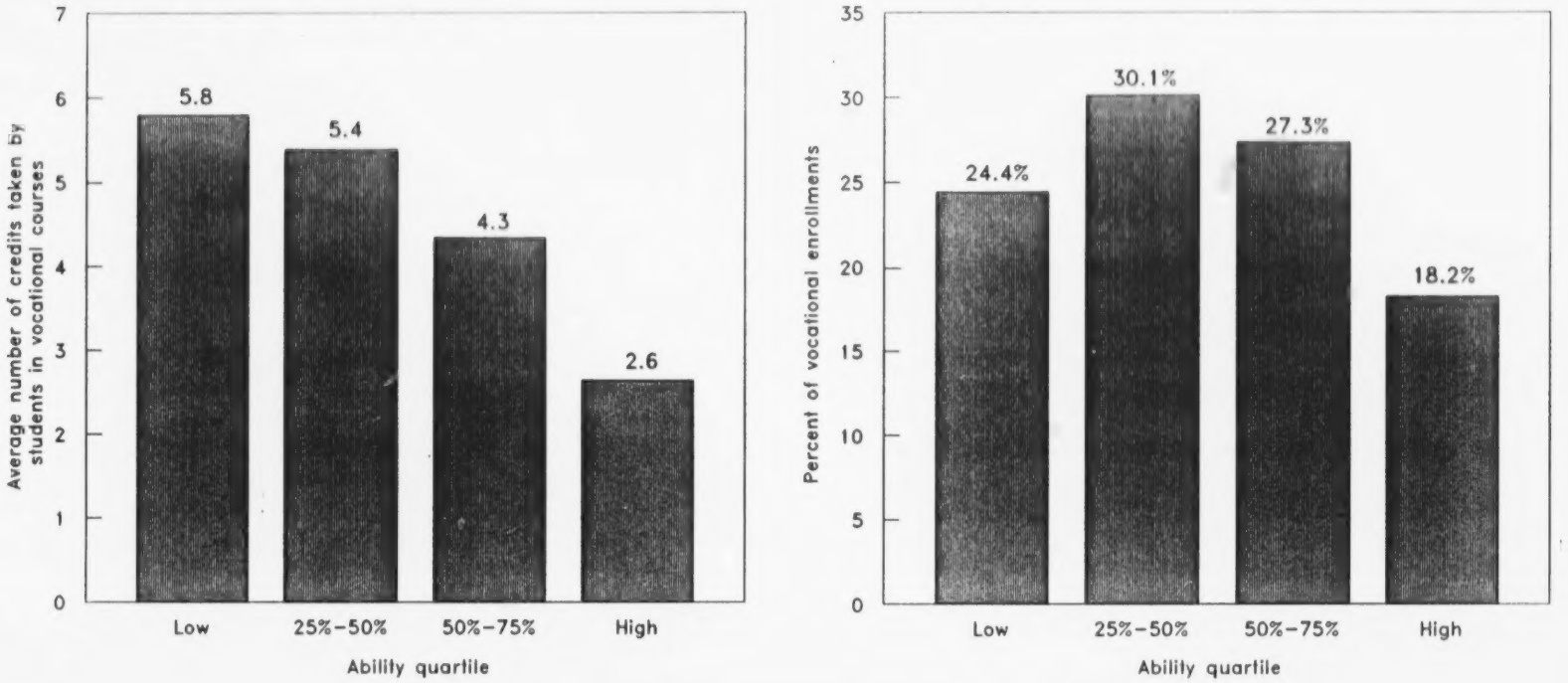
7. See John G. Wirt, "National Assessment of Vocational Education," testimony before the House Committee on Education and Labor, Subcommittee on Elementary, Secondary, and Vocational Education, Mar. 7, 1989, p. 6.

Figure 1-3

Student Ability[a] and Enrollment
in Vocational Education

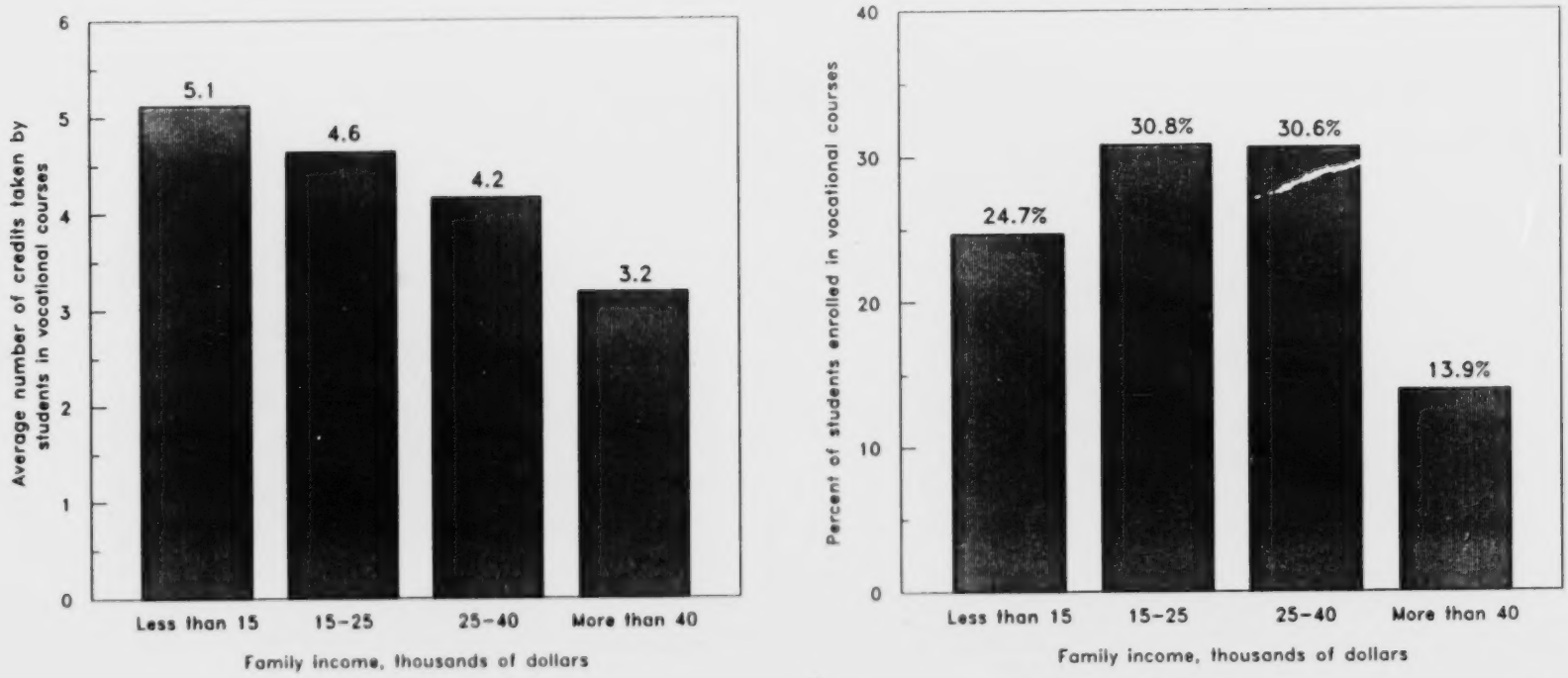


[a]As measured by verbal and mathematics achievement tests administered under the U.S. Department of Education High School and Beyond survey.

SOURCE: Office of Technology Assessment, based on the National Assessment of Vocational Education, First Interim Report (Washington DC: U.S. Department of Education, January 1988).

Figure 1-4

Students' Family Income and Participation
in Vocational Education



SOURCE: Office of Technology Assessment, based on the National Assessment of Vocational Education, First Interim Report (Washington DC: U.S. Department of Education, January 1988).

> "Vocational education is a good candidate for performance-based . . . policies for several reasons. First, [it] has a long though somewhat ill-defined tradition of defining accountability in terms of outcomes. For many years Federal vocational education policy has urged that the effectiveness of vocational programs be measured in terms of such labor market outcomes as placement in jobs related to training and employer satisfaction. . . . Second, vocational education has made extensive use of competency-based curricula and competency testing, which lend themselves to establishing more performance-oriented public policies. . . . Third, experience with performance standards and other outcome-based features of the Job Training Partnership Act . . . suggests that vocational education might successfully adapt them to its operations. . . . Fourth, the existence of Federal policy and Federal funding for vocational education offers the opportunity for crafting a stronger performance orientation [through] policies [that] would not require a new Federal initiative and new funding. . . .[8]

The principal objective of this Background Paper is to examine the possibility of instituting more stringent requirements for outcome-based performance measurement than are currently featured in the Perkins Act. While there can be many types of outcome measures for vocational education, OTA concentrated on two that are most frequently mentioned. The first is based on labor market outcomes, which are intuitively appealing because they link important objectives of vocational training to the subsequent work experiences of program participants and graduates. Productive and gainful employment ranks high among the objectives of American secondary schools, and is the traditional raison d'etre for vocational education and training. Job placement, earnings, unemployment, productivity, and employer satisfaction are all assumed to be affected, to some degree, by the quality of an educational program.

The second type of measure OTA examined is based on estimates of learning by students. Regardless of their labor market experience after school, how much students learn, and in which subjects, are important indicators of an educational program's

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8. E. Gareth Hoachlander, "Performance Based Policies in Vocational Education," paper prepared for the Research Conference of the Association for Public Policy and Management, Seattle, WA, October 1988.

quality. In fact, many people believe that testing of competencies is the single most important component of performance measurement.

Job-related competencies and subsequent labor market success are not the only accepted objectives of vocational education. There are a number of other measures that could be included in a comprehensive approach to performance evaluation. For example, some research has examined noneconomic effects of vocational education, such as job satisfaction and family stability.[9] Reduction of the dropout rate and participation in postsecondary education are two other outcomes often cited by experts.[10]

SCOPE AND OBJECTIVES OF THIS BACKGROUND PAPER

The House Committee on Education and Labor asked OTA to examine the relative merits of alternative performance measures for secondary vocational education. In particular, the Committee was concerned with two key issues: the technical feasibility of such measures, i.e., questions of data availability, accessibility, and commensurability; and the appropriateness of various measures, i.e., the extent to which they could provide valid information without distorting the goals of vocational programs or the behavior of program participants and personnel.

The central question addressed in this Background Paper is this: if Congress wanted to mandate performance measurement, for the purpose of diagnosing problems in specific vocational programs and/or as criteria for Federal funding, what would be the strengths and weaknesses of the two most frequently-mentioned strategies?

Chapter 2 addresses the use of economic indicators to measure secondary vocational program performance. OTA explored the available data that demonstrate the

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9. See, for example, Lawrence Hotchkiss, National Center for Research Into Vocational Education, *Noneconomic Effects of Vocational Education* (Columbus, OH: Ohio State University, 1987).
10. See Stern, op. cit., footnote 5.

relationship between vocational education and subsequent labor market performance, and then considered the possible uses of State-collected wage records data as a basis for outcome measurement. To gain some preliminary insight into the technical problems associated with using the wage records, OTA applied the method in a midwestern school district. In addition, this section reports on State efforts at data collection and analysis, based on responses to an OTA telephone survey conducted in December 1988.

Chapter 3 looks at occupational competency testing. OTA's analysis concentrates on two key questions: Do tests of occupational aptitude and competency predict future labor market performance? Do these tests provide reliable indications of program performance? The role of the States in measuring competency is highlighted in this chapter.

While OTA did not examine formal methods of measuring other plausible outcomes of vocational education, these do warrant further attention. Chapter 4 of the report outlines some of the basic issues surrounding these measures.

Box 1

Mandating Performance Standards in Federal Programs: The Job Training Partnership Act (JTPA)

During the 1980s, the philosophy of job training for the unemployed changed. From 1973 to 1982, the Comprehensive Employment and Training Act (CETA) was the Federal Government's vehicle for "manpower" training. Though CETA was a consolidation of numerous pieces of legislation enacted in the 1960s, it had no more stability than its predecessors. In its brief history, CETA was amended 8 times, had 12 different titles, and went through 26 separate appropriations. The instability of the program's design and funding resulted from the diversity of its objectives: at one time or another CETA attempted to remedy the adverse effects of automation, retrain experienced workers, create jobs, reduce juvenile delinquency, encourage high school completion, and conserve natural resources.[11]

With the legacy of CETA's problems, and with the cost-cutting consciousness of the "New Federalism" at hand, JTPA took shape during the recession of 1981. Championed by Senators Edward Kennedy and J. Danforth Quayle, JTPA was intended to be a more efficient job training system for the poor, designed to operate on less than one-half the funds of CETA, with control given to private business and State governments. Through a partnership between local

11. Robert Guttman, "Job Training Partnership Act: New Help for the Unemployed," *Monthly Labor Review*, vol. 106, March 1983, p. 3.

(continued)

government and business, represented by private industry councils (PICs), JTPA puts the design and administration of training programs at the local level, known as service delivery areas (SDAs). Where CETA relied on an army of auditors to monitor compliance with a multitude of method and access requirements, JTPA uses standards based on the labor market outcomes of participants. The Federal role is limited primarily to prescribing effective and enforceable performance goals.

According to the JTPA legislation, the Secretary of Labor is to prescribe performance standards to measure the increase in employment and earnings and the reduction in welfare dependency resulting from participation in the program. The Secretary must also prescribe standards relating to gross program expenditures. This is combined with a hierarchical management system where all levels of JTPA play a role in determining whom the system serves. The Department of Labor has developed adjustment models that are intended to hold SDAs "harmless" for serving individuals with characteristics that make them hard to serve or difficult to place. States play a major role by adding other standards, granting incentive awards to SDAs for exceeding standards and for serving particular hard-to-serve groups. Ultimately, it is the SDAs, the PICs, and the service providers that respond to these incentives and determine who

(continued)

is actually served in the program. All levels play important roles in determining the extent that the hard-to-serve are provided training opportunities in JTPA.[12]

12. Burt S. Barnow and Jill Constantine, *Using Performance Management to Encourage Services to Hard-to-Serve Individuals in JTPA*, Research Report No. 88-04 (Washington, DC: National Commission for Employment Policy, April 1988), p. 48.

Chapter 2

Economic Indicators of Program Performance

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Chapter 2

Economic Indicators of Program Performance

The impacts of vocational education on earnings, hours worked, unemployment and other labor market outcomes have been studied by economists for many years.[13] Their research typically relies on survey data that tracks the educational and employment experiences of large numbers of high school students over several years. These studies have attempted to address the general economic question — does vocational education pay? — but the data they have relied on can provide very limited information about the relative quality of specific vocational programs. Disaggregated, program specific data are necessary to ascertain whether students in a given high school program experience subsequent labor market advantages as compared to students who are not in that program.

STATE AND LOCAL EFFORTS

In January 1989, OTA conducted a telephone survey of State directors of vocational education to determine the extent of State activity in performance standards. States were asked both about placement rate and competency-testing activity, as well as about efforts to introduce academic material into the vocational education curriculum. OTA

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13. See, for example, Russell Rumberger and Thomas Daymont, "The Economic Value of Academic and Vocational Training Acquired in High School, *"Youth and the Labor Market: Analyses of the National Longitudinal Survey*, Michael E. Borus (ed.) (Kalamazoo, MI: W.E. Upjohn Institute for Employment Research, 1984); Paul Campbell et al., Ohio State University, National Center for Research in Vocational Education, "The Dynamics of Vocational Education Effects on Labor Market Outcomes," monograph, 1987; John Bishop, "Academic Skills and Occupational Training," in U.S. Department of Education, *Design Papers for the National Assessment of Vocational Education* (Washington, DC: February 1987); and Robert Meyer and David Wise, "High School Preparation and Early Labor Force Experience," *The Youth Labor Market Problem: Its Nature, Causes, and Consequences*, Richard B. Freeman and David A. Wise (eds.) (Chicago, IL: University of Chicago Press, 1982).

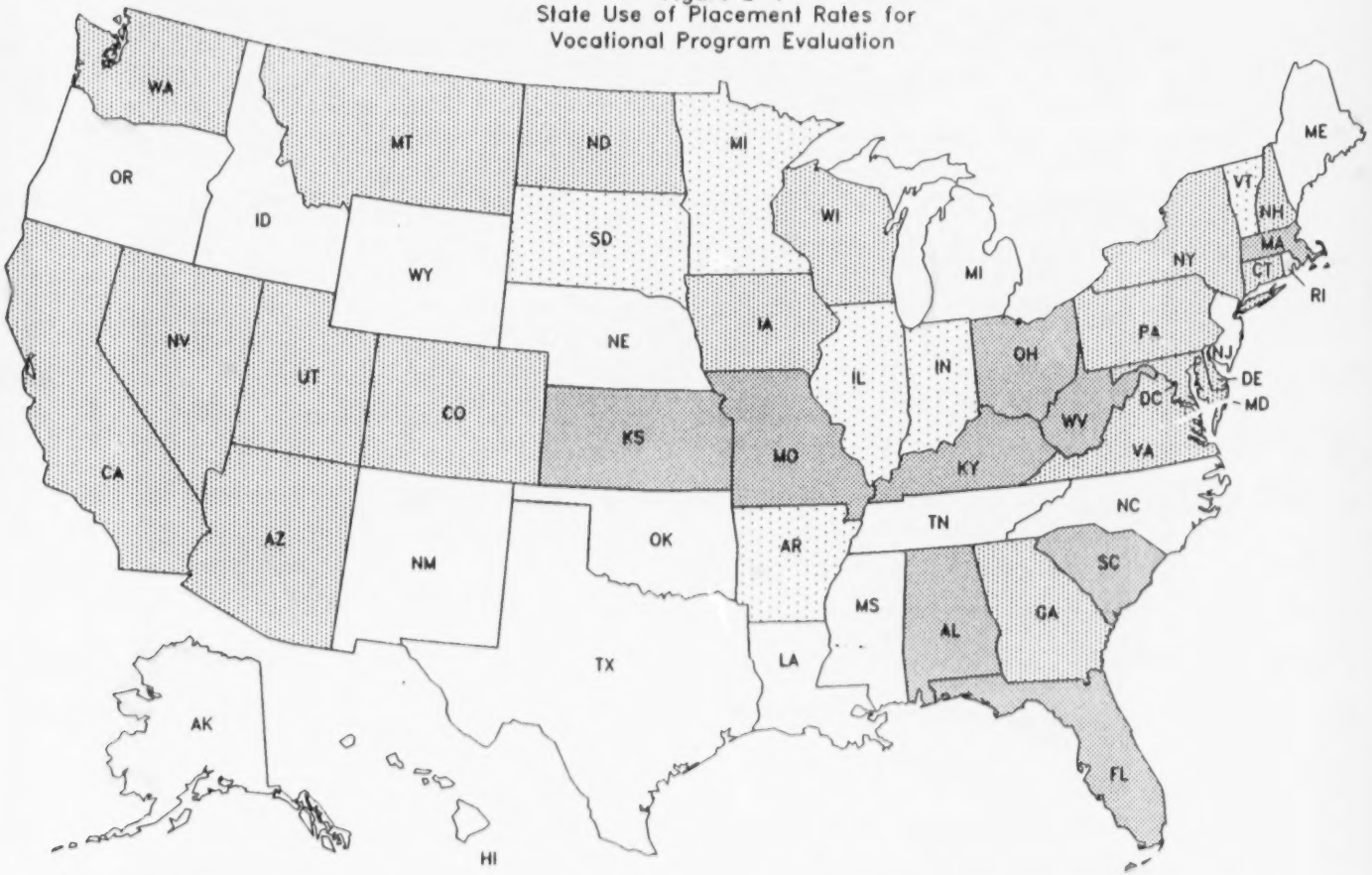
found that States use placement rate data within a larger framework of accountability, which usually includes information about a number of variables related to vocational education programs. Examples of these variables, many of which are specified in the Perkins Act, include access and support services for handicapped and disadvantaged students, appropriateness of equipment and supplies, safety of work areas, appropriateness of curriculum, existence and operations of advisory committees, provision of guidance and placement activities, and staff development.

Many States and school districts attempt to evaluate their vocational programs by tabulating labor market statistics of graduates with information from their transcripts. As shown in figure 2-1, 27 States use followup surveys to collect data on job placements of graduates, which in many cases includes information on wages, job tasks, and employers' views of employee job performance. Followup surveys are typically conducted 9 to 12 months after the student has left school and data is generally collected by district personnel and/or teachers.

Only nine States have established policies that directly tie placement rates to the distribution of funds. The established rates range from 50 to 70 percent, with three States requiring 50 percent placement, four requiring 60 percent, one requiring 65 percent, and one requiring 70 percent. Seventeen States use placement-rate data for program evaluation but do not link the rates to funding decisions. Six States are planning to use placement-rate data, of which one is considering required rates. The States that mandate placement rates usually provide technical assistance to deficient programs before withholding funds.

To gain additional insight into the implementation of placement rate standards OTA looked more closely at the policies of five States.

Figure 2-1
State Use of Placement Rates for
Vocational Program Evaluation



States collecting placement-rate data for program evaluation only (includes DC)

States considering or planning collection of placement-rate data

States not currently collecting placement-rate data

States with required placement rates tied to distribution of funds

State required placement rates:
50% - Alabama, Kansas, South Carolina
60% - Florida, Missouri, Ohio, West Virginia
65% - Kentucky
70% - Massachusetts

SOURCE: OTA telephone survey, January 1989.

Missouri

Since 1985, approximately 37 percent of Missouri's State funds for vocational education have been distributed to programs according to scores on two factors: 1) how well programs train students for jobs in areas of high market demand (demand is estimated from rankings prepared by the Missouri Occupational Information Coordinating Committee in cooperation with the division of Occupational and Adult Education of the Elementary and Secondary Education Department, using employment projections prepared by the State Employment Security Agency), and 2) placement of students in jobs related to training. Local placement performance is accepted as sufficient justification to continue a program that is identified as being of low priority using this ranking procedure. A bonus is offered for placing hard-to-serve students. The State provides districts with information regarding the dollar value of each of their programs based on the above two factors, thereby giving districts information needed to make maintenance or cancellation decisions.

In keeping with Perkins Act requirements, programs are also evaluated once every 5 years on process factors, such as whether they have their competency-based educational program in place and whether they have an advisory committee. These on-site evaluations, however, do not influence the distribution of vocational education funds. Missouri has not yet conducted a formal evaluation of the impact of their placement-rate policy.

Kansas

Kansas requires that 50 percent of its vocational education graduates find jobs related to the field in which they were trained. Students who have dropped out in the 11th or 12th grades can be counted as placements if the jobs are in the area of training. Programs that do not meet the 50 percent requirement are placed on probation and have 3 years to raise their rate. During those 3 years, the program receives technical

assistance from the State Education Department, and if a 50 percent placement rate is still not achieved, support is discontinued. Less than 5 percent of the programs in Kansas have failed to meet the standards.

South Carolina

South Carolina uses both positive and negative incentives to influence vocational education. The 50 percent placement requirement means that one-half of all students who complete defined courses are expected to find jobs. This requirement is different from those in effect elsewhere that are based on program, school, or district completions. Placements must be in the area of training and attendance at a postsecondary institution must also be in the area of training. South Carolina also includes dropouts in its count of successful placements if they obtain jobs in the area of training. Placement rates are verified by the State, and involve pulling of records, visits to employers, and interviews with employers and graduates regarding wages and employee satisfaction.

As a positive incentive, South Carolina's General Assembly allocated in 1984 $25 million to vocational education programs to be distributed over a 5-year period for the purchase of high-technology equipment. Districts are required to do a needs assessment every 5 years, based in part on labor market conditions, which is to be used in their proposal for funds to purchase the high-technology equipment. District plans and their needs assessment reports are read by a private sector panel. South Carolina also places strong emphasis on the academic aspects of vocational education and participates in a vocational education consortium of the Southern Regional Education Board, whose primary aim is to promote the infusion of academic material into vocational education.[14]

14. See ch. 4 for a more detailed description of the Southern Regional Education Board's performance measurement strategy.

An average of seven programs have been discontinued in each of South Carolina's 92 districts over the past 4 years. Discontinuances are reported to be based primarily on decline in labor market demand rather than on inadequate program quality. For example, programs in body and fender and building construction have been discontinued. The discontinuances are based on a combination of low placement rates and failure to qualify for the high-technology equipment funds.

Florida

Florida's legislature enacted a placement rate requirement of 60 percent in 1983-1984, then raised it to 70 percent in the next year. Programs that fail to meet the standard are automatically reviewed by the Florida State Department of Education, which then submits the review to a regional coordinating council along with a plan for improving the placement rate for that program. As of the 1985-1986 school year, any program in which the placement rate for completers was less than 70 percent for 3 consecutive years was ineligible for State funding. To compensate for adverse economic or demographic conditions, the Department of Education was given the authority to adjust placement rates at the regional level using a statistical method approved by the State board. Adjustments must be reviewed by the Legislature before submission to the State board.

Florida's unemployment rate for youth in 1987 was 16.1 percent. The placement rate requirement of 70 percent establishes the expectation that completion of a vocational program should increase the likelihood of job placement by approximately 14 percent over what would occur without special training.

Data on placements is collected at the local level, generally by the vocational program teacher with the assistance of a placement specialist. This data is then forwarded to the district and on to the State. The Florida Legislature specified that audits of accuracy regarding placement rates are to be conducted by the Office of the

Auditor General of Florida, although none have been conducted as yet. Florida's response rate on these followup surveys has increased from 62 percent in 1982-1983 to 89 percent in 1985-1986.

Florida is moving to a statewide system for tracking individuals who complete vocational programs. This system draws from employment data, postsecondary enrollment, and national military records, and uses students' social security numbers as identifiers. One limitation is that not all students have social security numbers and cannot be required to obtain or report one. Once this data is collected, it must be returned to the local education agencies, who then determine whether or not the placements are in areas related to training.

Florida has defined a vocational completer as a student who has completed a specified course of study and exhibits mastery of designated competencies. Exceptional students are not included in the computation of program placement rates if they do not meet these criteria. Also excluded from the computations are prison inmates, nonresident aliens, or aliens who are in the United States on nonimmigration visas. Students who are not located are counted as nonplacements.

In 1983-1984, 45 percent of the total programs were required to receive a modified program review, because they had not met the placement-rate standard. This rate dropped to 14 percent during the next 2 years. The number of students (both secondary and postsecondary) who were designated as having completed vocational programs declined by almost 12,000 during this same period. Possible reasons are that schools either are being more cautious about who qualifies as a completer, more selective regarding who is permitted to enroll in a vocational program, or that fewer students are electing to enroll in vocational programs. In addition, these same data show that, while placements in employment related to training increased, placements in continuing education and full-time military dropped substantially. No studies have been conducted to identify possible explanations of these trends.

Illinois

Seven "vital signs" comprise Illinois' model of vocational program evaluation. The vital signs, based on a medical model of diagnosis, include labor market justification, placement, enrollment, employer satisfaction, student satisfaction, student performance, and cost containment. A particularly interesting aspect of Illinois' accountability effort is their reliance on a computerized expert system that helps to identify causes of problems. Plans for improvement are designed collaboratively with local school personnel and State education staff, and are derived from the information gathered and analyzed by the expert system. If this system is demonstrated to be accurate, it could become attractive in other States, where the basic computerized model could be tailored to meet local needs.

WAGE RECORDS DATA AS A BASIS FOR PERFORMANCE MEASUREMENT

State and local efforts at performance measurement, while commendable, frequently fall short of providing accurate and statistically valid indicators of program quality. First, the data are self-reported by program graduates, who may have difficulty recalling the courses they took in school and who may be unwilling to give accurate earnings information.[15] Second, the surveys are usually conducted by school personnel,

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15. For example, in a study that matched transcript data against self-reported information, it was found that many students misclassified themselves: ". . . a number of those who reported themselves to be in the general track in high school actually took three or four vocational courses." See John Bishop, "Policy Evaluation With Archived Wage Record Data: Limitations of Existing Data Sets," in Northeast-Midwest Institute, *The Feasibility of a National Wage Record Database: Four Working Paper*, prepared for a conference on "Employment and Earnings Dynamics in the United States: Policy Issues and a Longitudinal Data Source" (Washington, DC: January 1989), p. 14. Also see Robert H. Meyer, "An Economic Analysis of High School Vocational Education, I: Vocational Education: How Should It Be Measured?" (Washington, DC: Urban Institute), unpublished monograph, Aug. 31, 1981.

which introduces a possible bias if program funding is tied to survey responses. Finally, most of these surveys have relatively low response rates, because graduates are hard to locate.[16]

These kinds of technical and methodological problems have always made vocational educators wary of performance measures based on economic outcomes. But recent changes in the way States gather earnings data have spurred renewed interest in the possibility of relatively cost-effective outcome-based performance measurement. As a result of amendments to the Social Security Act contained in the 1984 Deficit Reduction Act (Public Law 98-369), States now maintain an income and eligibility verification system based on employers' quarterly wage reports.[17] For the first time, fourth quarter earnings for 1988 will be available for all 50 States, from which it will be possible, in principle, to construct longitudinal earnings profiles for almost all working adults.[18] Covered employers report wages for employees who were on the payroll during the quarter, including the value of meals, lodging, and other remuneration. Thus, for example, earnings data for a June graduate, whose first full quarter of employment begins in July, would be available for retrieval beginning in January of the next year.

While there are possible sources of error in these data, due to reporting inaccuracies of various sorts, the wage records are typically quite reliable, and are considered greatly superior to self-reported information. Because they are employer-based, these data have the added benefit of linking earnings information with characteristics of reporting companies. In addition, because States pay unemployment insurance based on these data, there are strong incentives for accurate and timely

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16. In New York City, for example, the only graduates surveyed are those whose telephone numbers are the same as when they were in school.
17. This discussion is based on David Stevens, "Using Wage Records Data to Construct Measures of Secondary Vocational Education Performance," OTA contractor report, Dec. 12, 1988.
18. There are exclusions that do not severely hinder the usefulness of the data for secondary vocational education program assessment. See Stevens (ibid.) for a more detailed discussion of wage records coverage.

reporting. (Most States determine eligibility to receive unemployment compensation benefits based on covered earnings in the first four of the last five completed quarters.) While there is some justified concern with confidentiality issues, most knowledgeable observers conclude that appropriate uses of the data can be designed following strict guidelines to prevent disclosure of personal wage and employment information.

The principal advantages of the wage records data are:

- coverage is comprehensive enough for most tracking purposes;
- the data are available quickly enough for most types of evaluation;
- the data are more accurate than self-reported survey information;
- the data can be merged with other databases (such as military service records or education records), using social security numbers for student identification and then deleting individual identifiers for analysis purposes; and
- movement across State boundaries can be traced by establishing procedures for matching interstate records (several employment security agencies have already done this for their own administrative purposes.[19]

Despite these improvements in the quality and cost of data collection, however, the usefulness of the wage records system is limited by problems that exist with any kind of

19. See James Hanna, "The State Perspective on a National Wage Record Database," in Northeast-Midwest Institute, op. cit., footnote 15.

labor market data. A basic question is whether economic outcomes provide enough information to measure fully program performance. Many vocational educators are opposed to relying on these measures because of the difficulty in isolating the effects of participation in a vocational program from other factors that influence labor market performance.[20] For example, if individuals who choose to enroll in vocational programs are more interested and/or more experienced in specific skills than those who do not enroll, then it is difficult to measure the added value of participation in the program. Similarly, use of labor market outcomes requires, in addition to substantial background information on program participants, detailed information about employer recruitment and compensation practices, which may not always reflect accurately on either individual abilities or program quality. In addition, there is concern that emphasis on placements will induce schools to concentrate resources on students who are most likely to be placed, at the expense of those who need the most instructional attention. (The problem of "creaming," i.e., program managers' incentives to train the most likely-to-succeed individuals, is discussed in box 2, page 36). Thus, while the wage records offer the potential to assess relatively long-run labor market effects of vocational programs, there will likely always be a credibility problem.

There remain also some technical problems that need to be resolved to allow effective use of the wage records data (see also box 3, page 42):

- Administrative information about high school programs is not uniform. Individual institutions and school districts use unique classifications of vocational and academic courses, as well as different definitions of vocational students. While externally imposed

20. A recent national poll found that nearly 70 percent of the 265 responding school districts were opposed to the use of job placement rates as a measure of student success. See National School Boards Association, Office of Federal Relations, "Survey on Vocational Education: Summary and Recommendations for Reauthorization of Carl D. Perkins Vocational Education Act," unpublished document, February 1989.

uniformity could solve the comparability problem, it might also drive out important differences in curriculum and placements that stem from local school authorities' knowledge of local conditions.

- Although there are no legal barriers to the use of earnings data -- provided that individuals are not identifiable — the confidentiality question continues to pose problems. Some administrators, for example, who are uncertain about legal restrictions, take a cautious route and prefer not to make information available from earnings files. Relieving these uncertainties would be an important prerequisite toward wider utilization of the wage records data.

- The efficiency of the wage records approach is partly a function of the administrative costs associated with this kind of data management. Currently, the merging of data on students' exposure to vocational courses, their acquisition of various skills, and earnings and employment data requires coordination of at least two State agencies (Employment Security, which manages the wage records data, and Vocational Education, which collects school data).

Box 2

JTPA Revisited: Some Effects of Outcome Measures

The Job Training Partnership Act and its performance standards system have been operating for nearly 8 years and are considered by many observers to be remarkably successful. Labor Department officials note that almost 70 percent of trainees have found jobs.[21] Other supporters, in both political parties, claim that JTPA is proving to be a cost-effective tool for training and job placement. But a group of critics, equally bipartisan, argue that while the program is a significant improvement over CETA, its emphasis on cost and placement has shortchanged the very poor and hard-to-employ.[22] The performance standards create financial incentives for program managers to place applicants quickly in private sector jobs and at low cost. "[JTPA] pretty much serves the job-ready individual as opposed to the long-term unemployed, does not adequately reach the problem of youth unemployment and is severely limited in the number of people who are eligible to take advantage of training," said Rep. Augustus F. Hawkins, chairman of the House Committee on Education and Labor.[23]

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21. Neal R. Peirce and Robert Guskind, "Job Training for the Hard-Core Unemployed Continues to Elude the Government," *National Review*, vol. 17, Sept. 28, 1985, p. 2197.
22. Ibid.
23. Ibid., p. 2198.

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The issue of who is eligible for JTPA services brings up the problem known as creaming, which describes a situation where a service delivery area (SDA) might tend to enroll clients who are easiest to train and place because it can be done most cost-effectively. John E. Fisher, general chairman and chief executive officer of Nationwide Insurance Company and chairman of the Columbus-Franklin County (Ohio) private industry council (PIC), which provides basic skills and remedial programs for the least-qualified applicants, says "the performance guidelines are unintentionally pushing the program towards creaming, to be sure."[24] But others, such as Senator James M. Jeffords, (R-Vt), counter that with limited funds it is bound to happen. "Human nature tells you to serve those who come to you rather than people who have to be kicked in the rear."[25] This sentiment is echoed in another PIC chairman's job training strategy: "Find real, live jobs that clients can fill without going back to school. If they're illiterate, there are plenty of funds available for remedial education. If they've dropped out of high school, they'd better go back."[26]

In a recent report on the effects of JTPA performance standards on clients, services, and costs, the National Commission for Employment Policy (NCEP) found that in areas with low unemployment, most of the clients interested

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24. Ibid.
25. Ibid., p. 2199.
26. Craig Mellow, "Motown's Manpower Renewal," *Across the Board*, vol. 24, June 1987, pp. 31, 34-39, p. 36.

(continued)

in JTPA programs were those who had little work experience or had major barriers to employment, often requiring basic skills remediation. In contrast, in areas with high unemployment, those seeking JTPA services generally had more job skills and required help in retraining for new industries or occupations.[27]

The NCEP report found that while performance standards can influence the type of clients enrolled in JTPA, the effects are not large. Even in States with policies that are found to discourage services to welfare recipients, SDAs are enrolling a considerable number. For example, on average, 29.5 percent of adult clients in JTPA programs are welfare recipients, approximately equal to their incidence in the eligible population, which is 30.6 percent. The results of the evaluation indicate that even in States with policies that discourage service to hard-to-serve clients, SDAs are serving these clients only slightly less than their incidence in the population.[28]

Many researchers agree that in a human resource development program where the mission is clearly defined, a well-targeted set of performance standards can have the desired effect of making the process as efficient as possible. While well-defined goals can make a performance management system more likely to succeed, there is also

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27. National Commission for Employment Policy, *Evaluation of the Effects of JTPA Performance Standards on Clients, Services, and Costs*, Research Report No. 88-16 (Washington, DC: September 1988), p. 119.
28. Ibid., p. 73.

(continued)

evidence in JTPA of an emerging conflict between the goals of enrolling the hard-to-serve and encouraging effective programs.[29] "By definition SDAs take risks when they enroll hard-to-serve individuals, and if the performance standards system does not include adequate adjustments in the level of expected performance for serving these individuals, SDAs face a tradeoff between enrolling the hard-to-serve and achieving a high level of measured performance."[30]

In an attempt to manage this tradeoff, there has been increasing interest in defining hard-to-serve status in terms of deficiencies and barriers, such as lack of basic skills and minimal work experience, and incorporating these factors into the adjustment models. From this, standards can be developed to encourage services to hard-to-serve individuals. The inclusion of a new youth standard in 1988, called "employability enhancement," attempts to measure such things as work attitudes and job search skills. This expansion in performance standards recognizes that desired outcomes cannot always be measured simply by a placement rate.

The relative success of JTPA may lie in its clear and well-defined goals and objectives. JTPA's mission is to move individuals and families toward economic self-sufficiency. Unlike vocational education, which provides both technical and nontechnical training to "students" who plan to be both in

29. Ibid. Barnow and Constantine, op. cit., footnote 12, p. 3.
30. Ibid. (continued)

and out of the labor market, job training has restricted itself to more easily defined goals. When a consensus about program mission and goals exists, as in JTPA, appropriate measures of performance can be more easily designed.[31]

Differences in leverage and control through funding also set vocational education and JTPA apart. With nearly all JTPA's appropriations coming from the Federal Government, the use of incentives and sanctions based on the performance measures is a serious motivational tool. Secondary vocational education, on the other hand, has only a small percentage of its funding from outside State and local sources, substantially limiting the Federal Government's financial leverage.

There may be some important lessons for vocational education from the Federal, State, and local experiences with JTPA. In addition to the basic need to clarify program objectives, it is important to keep in mind that:

- performance standards appear to work well if local authorities are able to meet their other performance goals without major revisions;

31. Christopher T. King, *Cross-Cutting Performance Management Issues in Human Resource Programs*, Research Report No. 88-12 (Washington, DC: National Commission for Employment Policy, August 1988), p. iv.

(continued)

- incentive policies that reward programs for going beyond defined outcome standards may lead to reduced service for some hard-to-serve groups; and

- Federal standards based on minimizing program costs could have the worst impact on provision of services to hard-to-serve populations.[32]

32. See National Commission for Employment Policy, *Evaluation of the Effects of JTPA Performance Standards on Clients, Services, and Costs: Executive Summary* (Washington, DC: September 1988), pp. 4-5.

Box 3

Merging Wage Records and Transcript Data: A Demonstration

In November 1988, OTA conducted a small study to demonstrate the potential of merging wage records data and vocational education student transcripts.[33] OTA had access to all third quarter wage records for the years 1982 to 1987, from a single State Employment Security Agency. These data represent an example of what could be available at the national level if a national wage record archive or a distributed network of State Agency administrative records is established.

To complement the 6 years of wage data, OTA obtained social security numbers of 138 secondary vocational graduates from the class of 1984 of a local vocational high school. Assurances of strict confidentiality were required, including no use of names and the deletion of all social security numbers from the final analysis file.

The social security numbers were matched against each year's wage record file. The table below shows the "hit" rates that were achieved in matching the transcript data and the wage records, along with an earnings profile for the third quarter of each year.

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33. The study was conducted by David Stevens of the University of Missouri-Columbia, under contract with OTA. See David Stevens, "Using Wage Records Data to Construct Measures of Secondary Vocational Education Performance," OTA contractor report, Dec. 12, 1988.

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Year	Percent of "hits"*	QUARTERLY EARNINGS** Mean	Minimum	Maximum
1982	12	$ 718.32	$40.20	$1,512.95
1983	63	965.92	14.88	3,991.58
1984 Graduation	74	1,585.01	37.51	5,451.73
1985	63	2,284.65	27.99	6,164.00
1986	64	2,455.2	24.38	7,225.17
1987	67	3,035.94	61.42	7,077.83

*Employed anywhere in the State during the third quarter of the designated year.

**Total earnings reported by all covered employers for whom an individual worked during the relevant quarter.

This table demonstrates the ease with which longitudinal earnings data can be retrieved for those who complete secondary vocational education programs. Quarterly data can be summed to provide annual reported earnings figures. Any classification system of school courses or achievement indicators could be merged with the file, making it possible to evaluate vocational programs at the district, school, or even class level. External activities, such as military service, Federal Government employment, or enrollment in postsecondary education, could also be added.

Geographic information in the wage records file permits the location of the graduates' places of employment. Where major metropolitan areas cross State borders, hit rates relying on a single State's data will be reduced accordingly; interstate matching of wage records can resolve this problem. If a national wage records archive existed, it would be possible to match social security numbers against other States' records to detect reported employment in any other

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State. Two other types of information, the propensity for employees to remain with a given employer and/or in a given industry, can be derived using any starting and ending dates.[34] These data are important if job retention is selected as an outcome measure.

OTA did encounter several problems stemming from the ad hoc nature of the study. For example, the initial request for program completer transcripts also included an academic high school in the area, but social security numbers had not been maintained on the permanent student records. This problem would not recur if maintenance of social security numbers or other identifiers was mandated. (Note that due to recent changes in the tax law almost all children are acquiring social security numbers.) Many schools already have automated record systems, and most can be expected to adopt them in the next few years. Errors in data transcription at the school will increasingly be eliminated by the electronic transfer of information. It was also not possible to identify simultaneous enrollment in postsecondary

34. In other applications, Stevens has prepared matrices of intercounty and interindustry movement that reveal patterns of "staying," "exit," and "entry" affecting the specific sectors that are of interest. Tracing these flows is important in attempting to understand the role of secondary vocational education in economic development dynamics: who stays and who leaves, and how does each prosper through employment? See Stevens, op. cit., footnote 17.

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education and reported employment. This would require a separate matching of social security numbers against each higher education institution's records.

OTA also discovered confidentiality issues in this case study that could pose problems if the wage records system were implemented for performance measurement. For example, in 14 cases the data merge yielded only 1 graduate employed in a given county. This would reveal the identity of the individual to anyone who knew that a graduate of that class was working in that county. While that may seem to be innocuous information, the same observer might also cross-match this geographic data with industry-specific employment data containing earnings figures. Industry-specific "stayer" rates, i.e., the percentage of workers who remain in a given industry over time, present a frustrating confidentiality problem as well. While it would be useful to know how a new enterprise is staffed or the destination of workers affected by a plant closing or layoff, this information could be considered private. These questions would need to be addressed without revealing individual or other employing unit identities. There are ample precedents for devising procedures to comply with existing privacy laws (e.g., the Bureau of Labor Statistics, the Social Security Administration, and the Internal Revenue Service).

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Chapter 3

Measurement of Occupational Competencies

What students learn in school is at least as important an indicator of program quality as how well they do in the labor market after graduation. OTA examined the suitability of using various types of occupational competency tests for vocational program assessment. One key assumption implicit in the use of these tests is that the knowledge and skills they measure are correlated with one or more of the objectives of vocational education. Although vocational education has many objectives, the preparation of young people for productive and gainful employment ranks high. Thus, if mechanical ability, for example, is known to have a positive impact on the average earnings of workers in certain occupations, then performance on a test of mechanical competency can provide a measure of the quality of the educational program in which that competency was taught. (Training students in obsolete skills is not the sign of a quality program, no matter how well the skills are taught.) OTA examined the relationship between performance on a test of occupational competency and subsequent labor market outcomes.

Linking certain developed abilities to the probability of attaining various objectives of schooling, however, is insufficient for performance evaluation purposes. The second key assumption in the use of competency tests is that they provide information about the effects of school programs. Ideally, a test's items would be keyed exactly to the content of specific courses, and performance on the test would be an accurate gauge of how well those courses were taught. In practice, however, no test can fully sort out the effects of prior knowledge, prior experience, and innate ability from participation in a specific course or program.[35] And just as placements and earnings are insufficient indicators of

35. This argument is developed in greater detail in Alexandra K. Wigdor and Wendell R. Garner (eds.), *Ability Testing: Uses, Consequences, and Controversies*, Part I: Report of the Committee (Washington, DC: National Academy Press, 1982). See esp. pp. 25-29.

program quality because they confound program effects and individual or environmental attributes, scores on even the most detailed, content-specific tests provide only partial measures of program quality. OTA explored the relative merits of various types of tests — many of which are already available and in use in different parts of the country — for performance measurement.

APTITUDES AND COMPETENCIES

While aptitude tests are designed principally for assigning individuals to jobs and training programs for which they are well suited, their questions are often quite similar to those that appear on tests of achievement. As the National Academy of Sciences explained in a 1982 report: ". . . aptitude tests, intended to predict what a person can accomplish with training, and achievement tests, intended to measure accomplished skills . . . are not fundamentally different. They both measure developed ability, they often use similar questions, and they have often been found to yield highly related results."[36]

OTA explored the possibility of applying a widely-used test of occupational aptitude as part of a comprehensive system of program evaluation.[37] The Armed Services Vocational Aptitude Battery (ASVAB) is a 3-hour test administered by all branches of the military to determine eligibility of recruits and to match recruits to

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36. Ibid., p. 27. The National Academy explains how aptitude tests can be used to measure achievement: "A test for mechanical aptitude would be included in a battery of tests for selecting among applicants for pilot training since knowledge of mechanical principles has been found to be related to success in flying. A similar test would be given at the end of a course in mechanics as an achievement test intended to measure what was learned in the course. Of course, it would not be surprising to find that many people who did well on one of the tests would also do well on the other, nor that the achievement test could also be used to predict flying success." Nevertheless, experts in the field of testing and measurement caution that, on the continuum between ability and achievement, tests designed to measure the latter are typically better suited for performance evaluation than those intended primarily for measurement of aptitude or innate ability.
37. This section draws heavily on John Bishop, "Occupational Competency as a Predictor of Labor Market Performance," OTA contractor report, Dec. 12, 1988.

jobs. The original purpose of the ASVAB was to predict the success of new recruits in technical training; and since 1980 a major research effort has been under way to explore the uses of the ASVAB in predicting job performance.

The test battery consists of 10 subtests in mechanical comprehension, auto and shop information, electronics information, clerical checking (coding speed), numerical operations (a timed test of simple arithmetic), arithmetic reasoning, mathematics knowledge (covering the high school curriculum), general science, word knowledge, and paragraph comprehension. Unlike other competency tests that focus on specific occupations, ASVAB technical subtests assess broad technical ability and trainability for jobs involving the operation, maintenance, and repair of complicated machinery. The ASVAB does not measure specific proficiencies within these general technical clusters. The mechanical comprehension, auto and shop knowledge, and electronics subtests correspond roughly to technical trades, and performance on these tests can be interpreted as an indication of competency in the technical arena. Because the ASVAB is currently administered annually to 1 million high school students in 14,000 schools, as a tool in career counseling, there is interest in the possible uses of the ASVAB in performance evaluation.

Earnings and Employment

OTA first sought to determine whether vocational subtests of the ASVAB — and by extension, other similar paper-and-pencil tests of occupational aptitude — are valid as early indicators of labor market success in civilian occupations. The analysis is based on data from the National Longitudinal Survey.[38]

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38. During the summer of 1980 the Armed Service Vocational Aptitude Battery was administered to 94 percent of the youth sample of the National Longitudinal Survey (approximately 11,000 respondents). The earnings, wages, and unemployment rates for this sample were collected in followup surveys conducted in each year through 1986. Multiple regression models were used, to control for weeks employed, school attendance, years of schooling, highest level of schooling completed, years of college education, minority group status, census region, and unemployment in the local labor market — all

As shown in figure 3-1, ASVAB subtests measuring electronics information and mechanical, auto, and shop knowledge, as well as coding speed and numerical operations, are positively correlated with wage rates and earnings, and negatively correlated with unemployment, among young men. For men in the National Longitudinal Survey sample, there is a very substantial economic return to technical knowledge as measured by these subtests, largely because men with vocational education are likely to take jobs in the mechanical, blue collar, and manufacturing sectors in which employers value technical knowledge.[39]

Job Performance

Although economists often assume that earnings are directly correlated with job performance and productivity, there is also evidence of divergence between wage rates and performance.[40] It is therefore important to ascertain whether ASVAB scores correlate as well with measures of productivity as they do with earnings and employment.

To address this question OTA used a dataset in which ASVAB subtest scores were related to a hands-on measure of job performance.[41] The findings from this analysis

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factors that could influence earnings and employment — as well as academic ability, as measured by subtests on arithmetic reasoning, mathematics, science, word knowledge, and paragraph comprehension. See ibid., for detailed model specifications. Also see Mark J. Eitelberg et al., *Screening for Service: Aptitude and Education Criteria for Military Entry* (Washington, DC: U.S. Department of Defense, Manpower, Installations, and Logistics, September 1984).

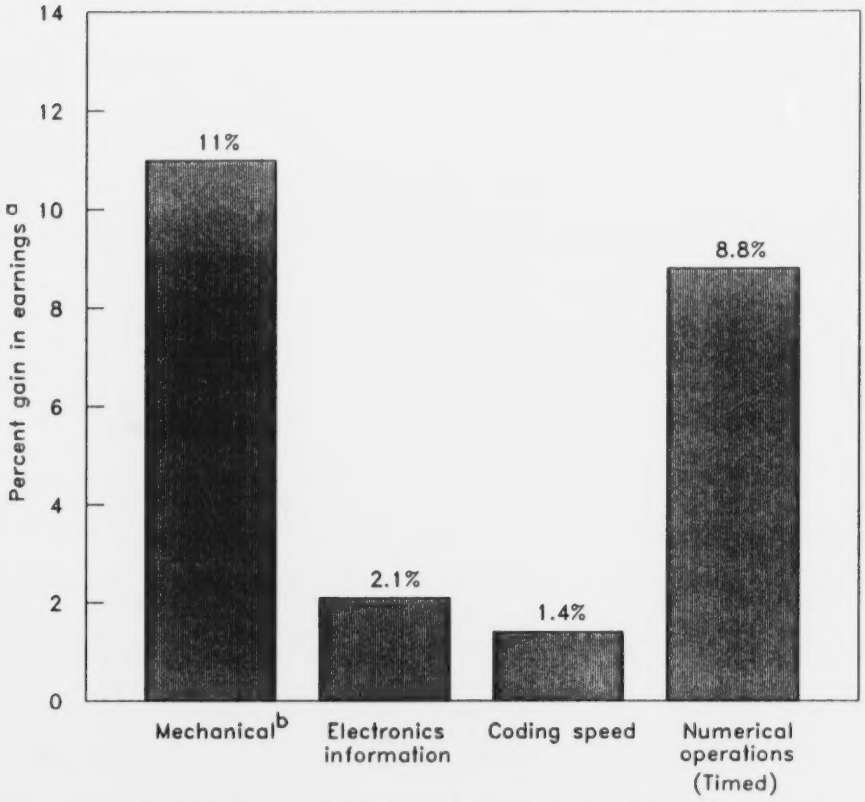
39. Except for coding speed, the Armed Services Vocational Aptitude Battery (ASVAB) vocational subtests did not correlate with women's labor market performance. These differences can be explained by the fact that women who do not attend college are still employed mostly in retail sales and clerical jobs where the technical skills included in ASVAB are considered less relevant by employers. See Bishop, op. cit., footnote 37.

40. One study found that an individual who is 20 percent more productive than average earned only 1.6 percent more in initial wages; after 1 year of employment, the more productive employees received only 4 percent more in nonunion firms (with about 20 employees), and experienced no wage advantage at all in unionized establishments (with more than 100 employees) or in large nonunionized firms (more than 400 employees). See John Bishop, "The Recognition and Reward of Employee Performance," *Journal of Labor Economics*, vol. 5, No. 4, part 2, October 1987, pp. S36-S56.

41. See Bishop, op. cit., footnote 37; and Milton Maier and Francis Grafton, U.S. Army

Figure 3-1

Correlation Between Occupational Competencies and Earnings of Young Men, 1984-85



[a] Percent gain in earnings per one standard deviation increase in ASVAB subtest score

[b] Mechanical Comprehension and Auto and Shop Information subtests equally weighted

SOURCE: Office of Technology Assessment, based on National Longitudinal Study data reported in John Bishop, "Occupational Competency as a Predictor of Labor Market Performance," OTA contractor report, 1988.

further support the validity of the ASVAB as a predictor of labor market performance. A small increase in all four of the nonclerical vocational subtests is correlated with an increase in job performance in skilled technical jobs, skilled electronics jobs, general maintenance jobs, mechanical maintenance jobs, missile battery operations, food services, combat occupations, and field artillery. Because many of these jobs have civilian counterparts, the analysis suggests that technical competencies measured by the ASVAB are valid determinants of worker productivity in many civilian jobs.

Program Evaluation: Caveats

OTA's analyses show that the ASVAB, and by extension similar paper-and-pencil tests of technical aptitude, can provide early indications of future labor market performance. For the purposes of this Background Paper, however, a central question is whether the ASVAB can provide sufficient information about how measured vocational abilities are acquired. For if such tests are to be useful in program evaluation, it must be possible to trace test performance to participation in specific school programs. OTA finds that the ASVAB does not meet this criterion, and that it could not become the sole or primary instrument of performance measurement, for the following reasons:

- ASVAB vocational subtests (in auto and shop information, mechanical comprehension, and electronics information) consist of a total of 70 questions, to be answered in 39 minutes. They do not provide sufficient information to judge an individual's technical proficiency in the tested skill areas.[42] In addition, the ASVAB does not cover many

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Research Institute for the Behavioral and Social Sciences, "Aptitude Composites for the ASVAB 8, 9, 10," Research Report 1308, unpublished manuscript, May 1981.

42. An analogy with academic testing is illustrative. A general science test that consists of 40 questions, 10 each on physics, chemistry, geology, and biology could provide a measure of general scientific knowledge without indicating anything about knowledge in any of the specific subjects.

skills that are taught in American secondary school programs. For example, there would be no way to measure an individual's competency in cosmetology, a field that attracts many women students.

- Participation in high school vocational education programs is only weakly correlated with the ASVAB scores.[43] Given the brevity of the vocational subtests this result is not terribly surprising. It suggests that using ASVAB scores to evaluate programs would require extensive additional data to control for student background, socioeconomic status, and other correlates of test performance. These data are costly to obtain, and the requisite statistical techniques are highly sophisticated.

For measurement of program performance, then, the ASVAB is an inadequate instrument. However, because it does predict future labor market performance quite powerfully for some students, it can be useful as part of a broad package of evaluation and program improvement. In particular, OTA considers the following potential uses of the ASVAB worthy of additional research:

- The ASVAB can be used to diagnose students' weaknesses in skills that are known to be important for certain occupations. For example, composite scores in word knowledge, paragraph comprehension,

43. Taken together with findings of strong correlations between the Armed Services Vocational Aptitude Battery (ASVAB) performance and earnings, on the one hand, and with other studies demonstrating strong correlation between vocational program participation and earnings in training-related jobs, OTA concludes that ASVAB cannot capture all the correlates of participation in vocational programs. Simply put, additional vocational education contributes to labor market success in ways that cannot be measured by ASVAB. For example, participation in certain vocational programs may be attractive to employers regardless of an individual's specific competencies; or students might learn skills in school that are not included in the test items.

arithmetic reasoning, and mechanical comprehension are used by the military to fill a wide range of jobs in the "health, social, and technological" fields. The extent to which a school uses the ASVAB to diagnose individual learning needs could be an indicator of that school's responsiveness to broad labor market demand. Note that this use of the ASVAB would include reliance on its academic subtests, which would signal the potential value of raising the academic abilities of vocational students.

- Because ASVAB scores correlate strongly with "trainability," and because a large number of firms provide ongoing education and training to their employees, test results could be useful in industry. To be effective, however, this use of the ASVAB would require employers to make greater use of test results and other student information than they currently do. It would be particularly important for employers to look at grades in specific courses as well as composite test scores.

- Finally, the ASVAB could provide information to be used in conjunction with other measures of performance. Early ASVAB scores, e.g., of incoming 10th graders, could establish baseline differences in schools in terms of their students' prior abilities and knowledge. Such information could become very valuable in making later comparisons of earnings and employment of graduates of various schools. In addition, comparing early scores with scores after several years in a vocational curriculum could provide information on net gains in knowledge and skills attributable mainly to program characteristics. The validity of this use of the ASVAB has not been explored by OTA.

OCCUPATIONAL COMPETENCY TESTING: STATE ACTIVITY

According to a recent survey, 13 States are engaged in testing the occupational competencies of vocational and technical students and 7 States are in the process of developing competency tests for vocational students. An additional 11 States are considering development, and 20 have indicated that they have no plans to initiate statewide vocational competency testing (see figure 3-2).[44]

Many States have formed consortia to pursue the development of competency-based curricula and tests in a cost-effective manner[45] (see box 4, page 61). Although several of these consortia only produce occupational tests, some also produce materials that list the duties, tasks, and tools needed for a broad range of jobs. Often these materials are based on detailed job analyses conducted by small groups that include vocational educators, experts currently working in the job, and/or by representatives of associations that represent the profession with which the job is identified. In some cases, tests are then developed to reflect the duties, tasks, and skills identified through these job analyses and packaged into tests or made available to States, schools, or districts in the form of banks of items. Educational agencies "buy into" these item banks, and can then select those items that match their vocational programs. Often, States purchase the test banks and make them available to local education agencies, who can then customize the tests to match their local curricula.

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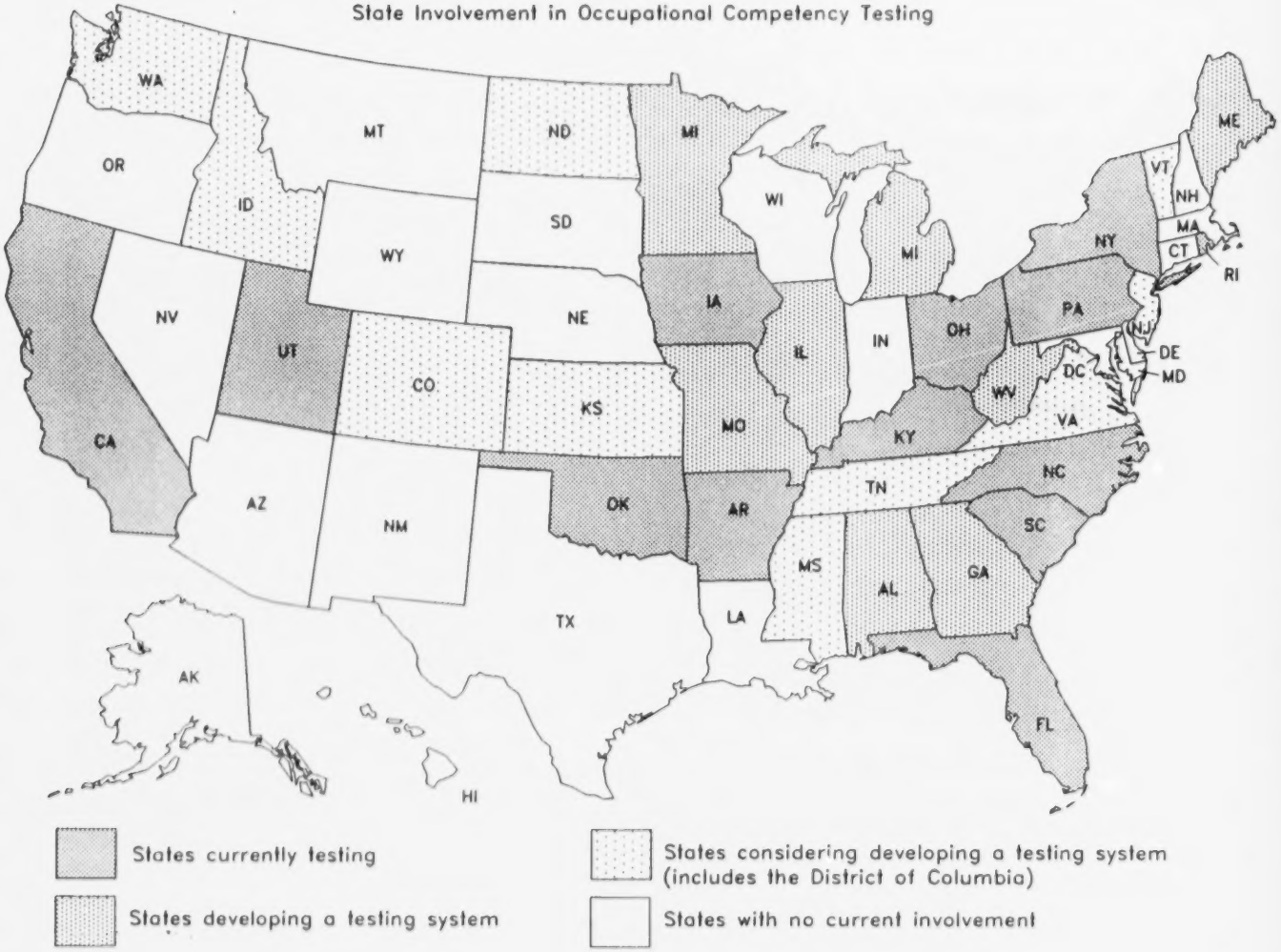
44. Rebecca Love-Wilkes, "1988 State of the Art Report on Statewide Student Competency Testing in Vocational and Technical Education," prepared for National Network for Curriculum Coordination in Vocational-Technical Education and the Southeast Curriculum Coordination Center, 1988.

45. Competency-based education systems develop curricula relevant to requirements for working in modern society, and attempt to certify student progress on the basis of demonstrated performance in some or all aspects of those requirements. Theoretically, such demonstrations of competence are independent of time served in formal education settings. See G. Grant et al. (eds.), *Competence: A Critical Analysis of Competence-based Reforms in Higher Education* (San Francisco, CA: Jossey-Bass Publishers, 1979), p. 6.

Figure 3-2

State Involvement in Occupational Competency Testing



SOURCE: Office of Technology Assessment, based on data from Rebecca Love-Wilkes, 1988 State of the Art Report on Statewide Student Competency Testing in Vocational and Technical Education (Mississippi State, MS: Research and Curriculum Unit for Vocational, Technical and Adult Education, 1988).

While these types of tests can provide more accurate information about program quality than tests of generic abilities, they are more time-consuming to develop; it is possible that by the time a test is administered, the skill it measures is obsolete. In addition, because they emphasize proficiency at highly specific occupational skills, these tests could discourage educators from exploring ways to teach broadly applicable skills that could benefit students in the long run. It is important to keep in mind the tradeoffs inherent in the application of various types of tests.

Occupational competency tests assess skills (tasks) and knowledge found in specific jobs (e.g., changing fuel filters or preparing schematic drawings), and are different from tests of academic competency (e.g., solving algebra problems or writing essays), and tests of employability skills (e.g., knowing how to conduct a job search, completing a job application, or exhibiting acceptable work habits.)

Tests can take several forms: paper and pencil objective tests (e.g., multiple choice, true-false), paper and pencil subjective tests (e.g., writing sample), performance tests (e.g., observations of student performance of a task), portfolio assessment (e.g., judging a body of work, such as photographs of hair styles completed over a semester's work). Each of these assessment modes has strengths and weaknesses, depending on how they are applied. While performance testing is generally more faithful to the actual task as performed in a job situation, it is costly to administer.

The level of cognitive complexity is an important characteristic of competency testing. Some skills or concepts are more complex than others and therefore more difficult to measure. At one extreme are measures of simple recall skills, such as "list the types of fuses and breakers." More complex measures are needed to assess an individual's ability to orchestrate and apply various configurations of simpler skills, as in the following item from a widely used test: "Redesign entrance service requirements for building expansion, renovation or installation of heavy powered equipment not accounted for under original construction."[46]

HOW GOOD ARE OCCUPATIONAL COMPETENCY TESTS?

If occupational competency tests are used to assess the effectiveness of a secondary school vocational program, it should be able to gauge the competence of students who are in that program. The test should also be a valid indicator of the skills and knowledge used in the job for which the vocational program is training students. Obtaining estimates of "job validity" requires input from those working in the jobs in question. Those who determine the composition of the test should be familiar with the jobs as currently practiced in that region, and should be active enough in the profession to be aware of trends and directions the profession is likely to take, particularly with respect to technological advances.

In some instances, the composition of the committees that determine what will be measured on these tests may be too dependent on vocational teachers who may not be as aware of the current job tasks and responsibilities or projected changes as someone currently working in the profession. A test developed with the exclusive input of teachers may neglect modern techniques and technology, which would undermine its validity for predicting job placement or performance.

One approach to determining a test's job validity is to compare the performance of experts — who have been performing the job successfully for several years — with that of novices — students beginning their training in a field or workers in a different occupation. Examining the ways in which experts answer specific test items gives important information about the validity of inferences from the responses of novices: for example, if an individual who is an expert automobile mechanic errs on a question about brakes or transmissions, that could signal the need to revise the question before

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46. From Vocational Technical Education Consortium of States (V-TECS), *Vocational Education Program Courses Standards, Industrial Education* (Atlanta, GA: 1988).

including it on a test administered to recent graduates. But expert-novice validity checks are seldom conducted by the agencies engaged in occupational testing at the secondary level.

A longer-term approach to evaluating validity would involve administering the test to vocational completers and then comparing job placement, productivity, performance, and wages of those who scored well on the test with those who scored poorly, in both the short term and the long term. OTA finds some evidence that specific occupational competency tests correlate quite strongly with job performance. An analysis that synthesized the results of 262 studies of occupational competency tests[47] concluded that the average correlation between test scores and supervisors' ratings of job performance was .51 (very high). In fact, this correlation was higher than that of any other predictor variable (such as ability tests, psychomotor tests, interviews, and biographical inventories). Other studies have found similar results[48] suggesting that occupational competency examinations appear to be valid predictors of job performance and promotion probabilities.

There are a number of risks inherent in any testing effort. One cited frequently is the incentive to "teach to the test": if teachers prepare students by teaching them to answer the items on a specific test, then the test provides a measure of how well students have learned answers to those test items but remains ambiguous with respect to students' learning of the more general skills and knowledge. However, this tendency should be distinguished from the case in which the use of a test is intended to influence instruction. For example, the New York State Department of Education has specified that all students must be proficient in certain occupational skills and knowledge, and has developed tests to measure those skills. Educators are responsible for tailoring their

47. M.D. Dunnette, American Petroleum Institute, "Validity Study Results for Jobs Relevant to Petroleum Refining Industry," unpublished manuscript, 1972.
48. See, for example, J.E. Hunter, "Causal Analysis, Cognitive Ability, Job Knowledge, Job Performance, and Supervisor Ratings," *Performance Measure and Theory*, S. Lundy et al. (eds.) (Hillsdale, NJ: Lawrence Erlbaum, 1983).

instruction so that it coincides with what is tested. In this case, poor test performance by students could reflect the failure of their teachers to meet defined curricular objectives. In general, tests used to evaluate the effectiveness of an instructional program should only measure what is taught. If there is a mismatch, then either the test or the instructional program should be revised.

One way to overcome the problem of teaching to the test (or what is also referred to as "measurement driven instruction") is to specify the domains of knowledge, skills, and concepts that are to be measured. The merits of these specifications are noteworthy: they allow test developers to produce a bank of consistent items that all measure a given skill in the same way. More important, these specifications can be given to teachers and curriculum developers so that they know what will be on the test without seeing specific test questions. However, very few test developers prepare such domain or item specifications, which are costly and intellectually demanding. It is not possible to ascertain the extent of teaching to the test that occurs in vocational programs without intensive case studies, and OTA was not able to determine whether the testing efforts reviewed for this Background Paper used item or domain specifications.

The subtleties of testing can be easily blurred in the rush to evaluate and improve programs. And because tests can create such powerful incentives for change — on the part of students, teachers, and schools — their application warrants close attention. The process of developing competency tests involves substantial input from those working in the field. If developed properly these tests can guide vocational instruction so that it meets the needs of employers and students. When linked to data reflecting labor market needs, the tests are useful for evaluating the relevance of vocational curricula to current and anticipated conditions. However, OTA finds that there are too many different occupations in which schools are training students for there to be a viable national competency test. The Federal Government could effectively work together with the

States in developing test guidelines and exploring new test methodologies. There is much to be gained from continued Federal support for research into the theory and practice of competency testing.

Box 4

State Activity in Development of Competency Tests

Several States and organizations are involved in developing and/or marketing occupational competency testing systems available for use in vocational education:

National Occupational Competency Testing Institute (NOCTI)

NOCTI develops and provides occupational testing services for teachers, students, and industry. At the present time, 47 States and the District of Columbia participate in NOCTI, and 23 States use NOCTI tests for certifying vocational teachers. Both written and performance tests are used to assess each occupation with tests covering factual knowledge, technical information, understanding of principles, and problem-solving abilities. The performance tests are administered in laboratory, industrial, or clinical settings and consist of work assignments that require 2 to 5 hours to complete. NOCTI test are only available for use at the end of a program, not for ongoing assessment during an instructional program.

Costs of assessment vary, ranging from $1 per student in architectural design to $45 per student in construction masonry. At the present time, 34 Student Occupational Competency Achievement Tests have been developed and validated. An additional 23 have been validated through field testing and are being prepared for distribution, and 11 are in

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the process of validation. NOCTI provides scoring and report services.

Ohio Vocational Education Achievement Test Program

The Ohio Vocational Assessment program is a joint venture between the Ohio Department of Education's Division of Vocational and Career Education and the Instructional Materials Laboratory at Ohio State University. As with the other testing efforts, the Instructional Materials Laboratory (IML) derives test items from an analysis of the duties and tasks involved in each occupation. These duty and task lists are developed by committees comprised of vocational teachers, State education staff, and a nonteacher member of the occupation. In addition, industry representatives throughout the State are surveyed for their comments on the task lists. Mathematics, science, and communications competencies relevant to the occupational competencies are included in the task analyses published by IML. Tests are comprised of two parts with approximately 175 questions for each part, averaging about one item for each task level. Performance tests are not a part of the IML testing effort. Each March approximately 60,000 vocational students are tested in the State of Ohio with scoring and report services provided to schools by IML.

The tests are designed for use by teachers, supervisors, and administrators for evaluation and diagnosis of vocational achievement for the improvement of instruction. Although

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participation in the testing program is voluntary, almost all eligible secondary schools in Ohio are involved.

Within the State of Ohio, the cost of testing per student is $1.50, and for schools outside of the State the cost is $2.50 if testing is done in March (the time scheduled for testing in Ohio) and $3.50 if done at some other time. No scoring services are provided outside of Ohio.

New York State Department of Education (NYSDE)

NYSDE is in the process of developing occupational competency tests that are given to students to assess their mastery of selected vocational coursework. At this point in the development process, these tests are primarily used for entry level courses, such as "Introduction to Occupations." Students must pass the tests as one of several requirements for high school graduation. New York's tests contain only multiple choice, primarily knowledge-based items, and do not measure students' abilities to perform job-related tasks. New York participates in virtually all of the testing consortia and makes these services available to schools and districts within the State who wish to test students in areas beyond those offered by the State competency tests. No studies of job-test validity have been conducted other than review of test items by those working in the field. At the present time, the tests developed by NYSDE are not available outside of New York.

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Vocational Technical Consortium of States (V-TECS)

V-TECS is a consortium of 25 State education agencies formed to promote the systematic development and implementation of competency-based vocational-technical education. Although most of the materials and test items are developed by State agencies, the process is guided by specifications provided by the V-TECS staff to help ensure quality control and consistency of products.

The V-TECS materials derive from thorough analyses of job tasks, skills, and knowledge. These analyses are conducted by actual observations of approximately 12 to 15 individuals as they perform a job. Based on these job analyses, task-skill lists are developed, and reviewed by 100 to 200 individuals who represent various aspects of the job or profession. The catalogs, which contain task descriptions for each job are then used by States or districts to develop test items, instructional materials, and curriculum guides.

The test items developed by the States are contributed to the V-TECS item banks from which States or schools can draw to comprise a test that matches the local curriculum. V-TECS does not currently provide intact tests or scoring services, but is considering moving to centralized test development, in part to ensure more quality control. V-TECS currently has catalogs (job descriptions) for 180 job titles, with one-third of those titles being updated at any one time. In addition, 12 to 15 test item banks have been completed and another 10 are nearing completion. Each item bank contains

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approximately 500 to 1,500 items for a job area, with 3 to 20 items for each skill. Many of these are tests of actual performance. Having this breadth in the number of test items offers some degree of test security and permits flexibility in generating multiple forms of a test. V-TECS is also in the process of identifying basic academic skills for infusion into their occupational materials, but have not yet addressed higher-order thinking or problem-solving skills.

The costs of participation in V-TECS is $20,000 per State per year. As part of their agreement, each State agrees to produce one (small States) or two (larger States) V-TECS products.

Oklahoma State Department of Vocational and Technical Education

Oklahoma offers one of the most advanced competency-based curriculum and testing systems in the country. They have been leaders in a competency-based curriculum for over 25 years and in 1983, began a systematic and comprehensive effort in occupational testing. At the present time, they have completed development of test batteries for 168 occupations, each of which consists of three types of tests. The first is the traditional multiple choice (cognitive) test, the second is a scenario that is designed to assess students' decisionmaking skills within the occupation, and the third is a performance test. In addition, 600 to 1,000 multiple choice test items have been developed for each occupational test battery. This permits the composition of a variety of

(continued)

randomly generated tests drawn from the larger battery of test items that measure a single domain.

All test items are keyed to duties and tasks that have been identified by committees of industry and educational representatives. Approximately four to six individuals representing each group sit on a committee. There is a great deal of concern with ensuring that the duties, tasks, and test items represent the most recent state of the industry.

Oklahoma does not require use of these tests, but makes them available to local programs for use in evaluating students' mastery of competencies and for identifying strengths and weaknesses in curriculum and instruction. At present, approximately 60 percent of the schools in Oklahoma have used the tests in some way. Apparently there is some concern on the part of teachers that they will be evaluated on the basis of their students' performance, although it is the teacher who requests the test from the State and who receives the test results.

The cost of the duty-task lists are $2 to $4 for in-state teachers and for out-of state, the cost is $6 per occupation contained in a book, which may range from 3 to 14 occupations per book. The cost of a test for out-of-state purchasers is $50 and contains 20 student packages, and includes all three types of tests mentioned above. Oklahoma does not provide scoring or reporting services for those

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outside of the State. Approximately 95 percent of the occupations taught in secondary vocational programs are covered by the Oklahoma system.

Chapter 4

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Chapter 4

Other Performance Measures

Vocational education at the secondary level has many objectives in addition to job preparation and job placement.[49] Three particularly important areas not examined by OTA are discussed in this section: academic skills, higher-order thinking skills, and postsecondary educational attainment.

ACADEMIC SKILLS

Many recent reports have called for elevating the basic academic skills of all students. The National Governors' Association, for example, argued that the task of vocational education is to prepare ". . . workers who are both well educated with the ability to reason and adapt, and well trained to perform specific work tasks."[50] (See box 5, page 75.)

Forty-two States responding to OTA's telephone survey reported efforts to introduce academic material into the vocational curriculum. As shown in figure 4-1, 32 States are in a consortium that is developing special courses in applied mathematics, science, and communications.[51] Two States currently require the assessment of vocational students' academic abilities, and a consortium of southern States has been formed to advance the development of basic competencies of students enrolled in vocational programs (see box 6, page 77).

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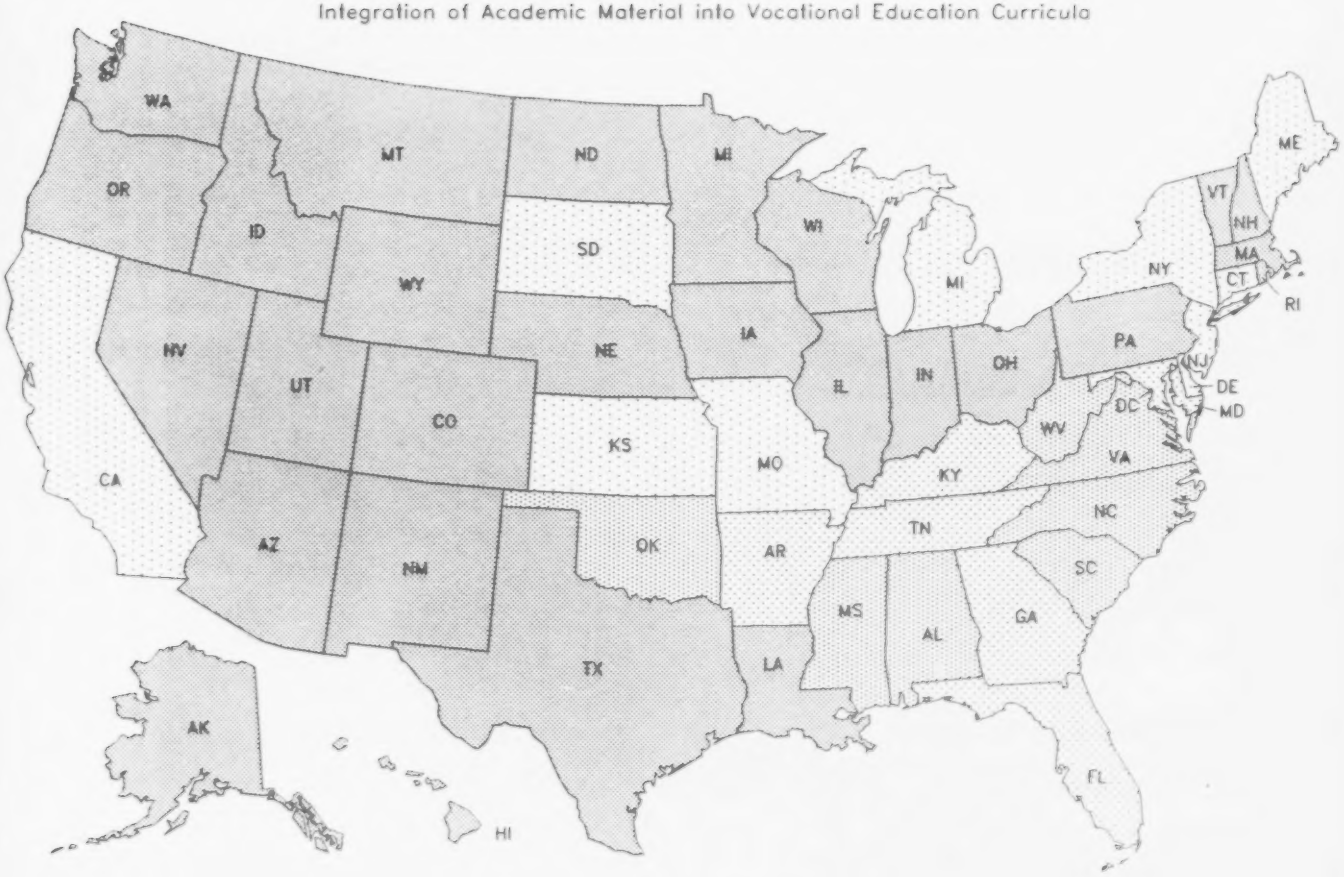
49. For a discussion of noneconomic effects of vocational education, see Lawrence Hotchkiss and Linda Dorsten, "Effects of Tracking on Post-High School Outcomes," *Sociology of Education and Socialization*, vol. 6, Ronald Corwin (ed.) (Greenwich, CT: JAI Press, 1987), pp. 191-219.
50. National Governors' Association, "Draft Policy Statement on Vocational Education," unpublished manuscript, 1988.
51. This development work is being conducted through a consortium of State agencies called the Center for Occupational Research and Development (CORD), in Waco, TX.

Figure 4-1
Integration of Academic Material into Vocational Education Curricula



States using CORD curriculum materials[a]

States using CORD and SREB curriculum materials

States using SREB curriculum materials[b]

States using their own curriculum materials

[a] Center for Occupational Research and Development (CORD) consortium
[b] Southern Regional Education Board (SREB) consortium

SOURCE: OTA telephone survey, January 1989.

Many analyses point to a long-term shift toward higher-skill jobs.[52] It is important to note that while the rate of growth in jobs that require more advanced skills is quite high, the majority of the total number of jobs will continue to require relatively low skills. Compared to workers who have good academic skills, workers who are deficient in basic skills will experience longer durations of unemployment and will have greater difficulty finding new jobs at their previous wage levels.[53]

Another factor contributing to the demand for a better educated work force is the restructuring of jobs. Many jobs that were once quite simple have become more complex.[54] In the insurance industry, for example, a single claims adjuster now does the work of five. The computer has eliminated many jobs, and the customer assistance clerk, claims adjuster, file clerk, messenger, and policy writer have been collapsed into a single position that demands advanced levels of communication and thought. The adjuster must be able to analyze a customer's needs and interpret and use the multiple arrays of information now available through computerized databases. Insurance companies that formerly hired high school dropouts or graduates to fill the jobs of messenger and file clerk now hire individuals with at least 2 years of college.

As technology has changed, so has the management philosophy of some organizations. For example, team work has become one strategy to handle greater

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52. See, for example, Sue E. Berryman, "The Economy and American High Schools: What Should We Teach? When? How? To Whom?" presented at the Tenth Annual Research Conference, Association for Public Policy Analysis and Management, Seattle, WA, Oct. 27-29, 1988.

53. M. Podgursky, "Job Displacement and Labor Market Adjustment: Evidence From the Displaced Worker Survey," prepared for National Academy of Sciences, Panel on Technology and Employment, 1987; P.O. Flaim and E. Sehgal, "Displaced Workers of 1979-83: How Well Have They Fared?" *Monthly Labor Review*, vol. 108, No. 6, pp. 3-16.

54. Thomas Bailey, National Center on Education and Employment, Teachers College, Columbia University, "Education and the Transformation of Markets and Technology in the Textile Industry," Technical Paper No. 2, 1988; Thomas Bailey and Thierry Noyelle, National Center on Education and Employment, Teachers College, Columbia University, "New Technology and Skill Formation: Issues and Hypotheses," Technical Paper No. 1, 1988; Thierry Noyelle, *Beyond Industrial Dualism* (Boulder, CO: Westview Press, 1987); and Thierry Noyelle, National Center on Education and Employment, Teachers College, Columbia University, "Services and the New Economy: Toward a New Labor Market Segmentation," Occasional Paper No. 5, 1988.

workplace complexity; but team work requires skills in problem identification, conflict resolution, and project evaluation that many workers may need to acquire.[55]

For these reasons, many people advocate the inclusion of basic academic competencies in performance measurement. However, there are also many people who believe that the primary goal of vocational education should be mastery of occupational skills. Clearly there is some overlap. The problem is how to fine-tune the blend of job-specific and generic skills in a curriculum that may already be quite dense. While some educators and administrators believe that schools can accommodate both, there is also some evidence that too much emphasis on academic content could undermine the vocational curriculum and leave vocational students worse off than before.[56]

There are other reasons why OTA urges caution in the implementation of stringent academic requirements. First, many of the students enrolled in vocational education programs are there precisely because they were not successful in more academically-oriented classrooms. Adding more rigorous academic material to the vocational curriculum could frighten off the very students for whom vocational education is successful. Second, proponents of a more occupationally-oriented vocational curriculum point out that vocational graduates can support themselves through college thanks to the skills they acquired in high school. Since college-going is increasingly seen as an objective for many students who complete vocational programs in high school, it would be a mistake to weaken these students' technical occupational credentials. Third, there

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55. In fact, when management agrees to fundamental changes in the decisionmaking role of employees, productivity can improve even among a work force whose skill level was originally considered inadequate. See, for example, Murnane, op. cit., footnote 1, p. 218; Richard M. Cyert and David C. Mowery (eds.), *Technology and Employment: Innovation and Growth in the U.S. Economy* (Washington, DC: National Academy Press, 1987); and Berryman, op. cit., footnote 53.

56. See, for example, William Clune et al., Center for Policy Research in Education, Eagleton Institute of Politics, Rutgers University, "The Implementation and Effects of High School Graduation Requirements: First Steps Toward Curricular Reform," unpublished manuscript, 1989. In an article in *Education Week* (Feb. 15, 1989, p. 5), Clune is quoted as saying that ". . . vocational courses were the major casualty of the increased academic coursetaking. . . . We saw evidence that the new requirements made it difficult to complete logical, and even required, sequences of vocational courses."

are reasons to be skeptical about some projections of skill requirements, as well as about statistical correlations between performance on tests of cognitive ability and job performance.[57]

HIGHER-ORDER THINKING

Many educators have come to believe that knowing how to learn has become as important as what is learned.[58] As one researcher has argued: "We are moving into an era in which the traditional separation between working and learning is disappearing, with learning becoming increasingly integrated into a person's work life." Our aim, claims another researcher, should be to develop "expert novices" who, ". . . although they may not possess sufficient background knowledge in a new field, know how to go about gaining that knowledge."[59] The term most commonly associated with reasoning and problem solving is "higher-order thinking skills." This is an abstract term, difficult to define and even more difficult to observe.[60] But it is relevant to performance

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57. For a more thorough treatment of these issues see Murnane, op. cit., footnote 1, pp. 219-225. Murnane points out that while certain cognitive skills are important for all students, it is not entirely clear how high their skill levels must be: ". . . the best available information indicates that enhancing productivity growth will require that all students be provided with threshold levels of literacy and problem-solving skills, as measured on paper-and-pencil tests. Extremely high scores on the types of standardized tests typically used in schools to measure cognitive skills may not be necessary for productive performance in the labor force." (p. 224)

58. This attitude, too, is controversial. See E.D. Hirsch, "The Primal Scene of Education," *New York Review of Books*, Mar. 2, 1989, pp. 29-34.

59. See Noyelle, Beyond Industrial Dualism, op. cit., footnote 55; Robert Glaser, "Teaching Expert Novices," Educational Researcher (Washington, DC: American Educational Research Association, December 1987); and Berryman, op. cit., footnote 53, who lists the following components of knowing how to learn: ". . . knowing how to identify the limits of one's own knowledge, how to ask germane questions, how to penetrate poor documentation, and how to identify sources of information."

60. One researcher suggests that higher-order cognitive skills are those that involve the orchestration and practical use of the simpler skills — like computation in school arithmetic. See Susan F. Chipman, *What is Meant by "Higher-Order Cognitive Skills"* (Arlington, VA: Office of Naval Research, 1987).

Another definition uses the following characterizations of higher-order thinking: nonalgorithmic, meaning that the path of action is not fully specified in advance; complex, meaning that the total path is not mentally "visible" from any single vantage

measurement in vocational education because of the interest in moving beyond simple measures of short-run job placement and toward providing students with ". . . a job with a future — a job that provides personal growth, the chance to master new skills, and the opportunity to earn promotions."[61] To the extent that these higher skills can be diagnosed and measured, they could become elements in a comprehensive system of performance measurement. At present, however, testing methods have not reached that level of sophistication, which suggests that the Federal role should be restricted to support for basic research.[62]

EDUCATIONAL ATTAINMENT

Apart from what students learn in school, how far they go in school has important consequences of its own.[63] Finishing high school has significant advantages: between 1961 and 1981, the average earnings of full-time working men (aged 25 to 64) with 1 to 3 years of high school fell from 87 to 75 percent of the average earnings of a comparable group with 4 years of high school. Thus, it is understandable why reducing the high school dropout rate is frequently mentioned as an important objective of vocational

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point; often yielding multiple solutions, each with costs and benefits, rather than unique solutions; involving nuanced judgment and interpretation; requiring the application of multiple, sometimes conflicting, criteria; involving uncertainty — not everything bearing on the task is known; involving self-regulation of the thinking process, not regulation by others; involving imposing meaning, finding structure in apparent disorder; and being effortful." See Lauren Resnick, *Education and Learning to Think* (Washington, DC: National Academy Press, 1987), p. 3.

The limited current base of knowledge about higher-order cognition is discussed in a recent OTA Technical Memorandum on elementary and secondary schooling for future scientists and engineers. See U.S. Congress, Office of Technology Assessment, *Elementary and Secondary Education for Science and Engineering*, OTA-TM-SET-41 (Washington, DC: U.S. Government Printing Office, December 1988), pp. 77-81.

61. The William T. Grant Commission on Work, Family and Citizenship, *The Forgotten Half: Pathways to Success for America's Youth and Young Families* (Washington, DC: 1988).

62. Four States are already either planning or implementing the assessment of higher-order thinking and problem-solving skills.

63. This discussion draws on Stern, op. cit., footnote 5, pp. 10-12.

education. Indeed, the fact that so many students elect to take vocational courses in high school means that some students would have less reason to come to school if those courses were not available. While statistical studies of the effect of vocational coursework on dropout rates have been ambiguous, continued research in this area could be fruitful and might yield new quantitative measures of program performance. Similarly, the propensity for vocational students to attend college — again, independently of their long-run labor market outcomes — warrants further study.

Box 5

The Need for Basic Skills: Mounting Pressure[64]

Future jobs will be restructured about every seven years and work and learning will be inseparable.

-David Kearns, Chief Executive Officer of Xerox Corp.

More than half of all new jobs created between 1984 — 2000 will require some education beyond high school, and almost a third will be filled by college graduates. Today, only 22 percent of all occupations require a college degree.

-Bureau of Labor Statistics, U.S. Department of Labor

The pace of technology development now is so great that life cycles for electronics products and processes already have collapsed to three to five years, and rarely will exceed five to ten years in most other industries. As a result, any set of skills also can be obsolescent in five to ten years. Continuous re-skilling must be a top national priority.

-U.S. Department of Commerce

Tektronix, an Oregon based manufacturer of electronic equipment, tried to shift its traditional assembly line workforce to a flexible manufacturing system four years ago. The company discovered that 20 percent of its production workers lacked rudimentary skills needed for the transition. Tektronix is solving its problem by contracting with nearby Portland Community College to run a remedial on-site program in basic math and English for its many non-English speaking assemblers. Along the way, Tektronix added courses to enhance such skills as team building, negotiating, and effective time management.

-Fortune Magazine, Apr. 11, 1988

64. The following text is quoted from U.S. Department of Education, U.S. Department of Commerce, and U.S. Department of Labor, *Building a Quality Workforce* (Washington, DC: U.S. Department of Labor, July 1988).

(continued)

Research done at Indiana University has found that some 70 percent of the reading material in a cross section of jobs nationally is now between 9th grade and 12th grade difficulty (some 15 percent is even higher) — and it is likely that the job and social requirements for literacy will increase even more in the years ahead.

-Business Council for Effective Literacy Newsletter, April 1988

Experts both in and out of government agree that the competitive global marketplace, increased domestic competition due to deregulation, the pace of technology development, shorter product life cycles, and new flexible production processes all require more adaptable, more highly educated entry workers in order for our country to remain competitive.

-Building a Quality Workforce, U.S. Department of Education, U.S. Department of Commerce, and U.S. Department of Labor, 1988

Box 6

Academic Material in the Vocational Curriculum: State Efforts

The Southern Regional Education Board (SREB) is a consortium of 13 States working toward introducing academic mathematics and science material into the vocational education curriculum.[65] The stated purpose of SREB is to: ". . . advance, apply, and evaluate approaches that will strengthen the development of the basic competencies — communication, science, mathematics, critical thinking, and problem solving — of students enrolled in vocational programs."[66]

Educators at 33 sites in consortium States are implementing a variety of strategies including:

- having vocational students take higher-level communications, mathematics, and science courses;

- increasing the amount of emphasis and instructional time in vocational courses

65. The participating States are: Alabama, Arkansas, Florida, Georgia, Kentucky, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia, and West Virginia.

66. James E. Bottoms, "The Relationship Between Vocational and Academic Education," prepared for Policy Studies Associates, Inc., Washington, DC, November 1988.

(continued)

devoted to basic competencies that underlie the occupational field of study;

- providing remediation to students in need;

- providing staff development to vocational teachers on how to incorporate instruction in basic academic subjects.

An evaluation plan draws information from multiple indicators of program effects, including results from the National Assessment of Educational Progress (NAEP) tests in mathematics, science, and reading; transcript analysis; student opinions; completer and employer followup information; and classroom observations designed to measure the emphasis being placed on academic competencies. Correlations will be conducted to determine the relationships among vocational education experience (e.g., curriculum, instruction, counseling), NAEP scores, and students' post-high school employment. Student test scores will be compared both with other students of similar background (e.g., sex, race, type of vocational program, parent education), and also with the national NAEP sample. An added feature is that this system provides the ability to analyze changes over time. NAEP was administered to a group of students in May 1988 and analysis of the results is under way.

(continued)

Preliminary analyses conducted by the Ohio State University and reported in an memorandum to SREB members, reveal that:

> . . . completing a general mathematics course added about three points to a student's NAEP mathematics score. On the other hand, completing a pre-algebra course resulted in a 9-point increase; Algebra I, a 12-point increase; and geometry, a 14 point increase. Further, the average NAEP mathematics score for students who said that their vocational teachers often stressed mathematics was 9 points higher than the average score of students who said that their vocational teachers seldom or never stressed mathematics.
>
> The NAEP results also provide some insight for improving the science achievement of vocational completers. For example, students in pilot sites that provided vocational completers with lab-based science courses scored approximately 20 points higher than those students from pilot sites where science courses were predominantly textbook — and information — centered.[67]

The director of SREB recommends that NAEP be used nationwide to assess the academic competence of vocational students. However, he does not see the need to use the results of NAEP to determine funding at the Federal level, since he believes that the impact of publicizing the test results at the State and local levels will provide the needed incentives for improvement.

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67. James E. Bottoms, memorandum to State and Local Pilot Site Coordinators of the Southern Regional Education Board, Jan. 10, 1989.

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